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ELECTRICAL WORLD

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UTILITIES' KNOTTIEST PROBLEM

•

POWER-STATION COST REDUCTION

•

PULP-MILL LOAD CONTROL PAYS

•

HUMANIZING THE KILOWATT

•

FINANCING DEALERS

•

SAVES WITH CAPACITORS

•

QUALITY IN CABLE SHEATHS

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REVISED ORDERS SHORTEN OUTAGES

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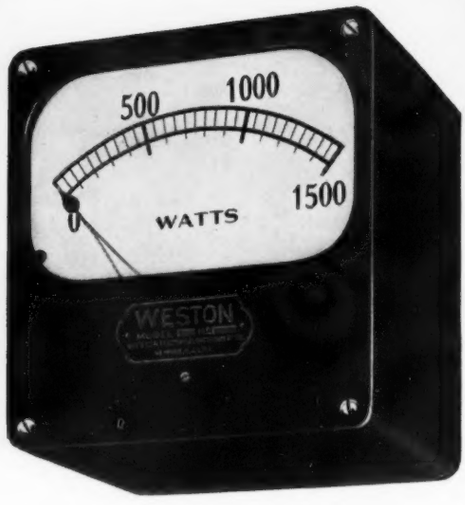
A.I.E.E. REPORT

A summary of the discussions before the American Institute of Electrical Engineers' convention will be presented in the February 2 issue

INSTRUMENTS OF DEPENDABILITY



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Reader's Guide to This Issue

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THIS INDEX is merely a convenient guide. Many articles will appeal to several reader groups—many will apply to all. News and other departments are of general interest.

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MANAGEMENT • ENGINEERING • OPERATION • UTILIZATION

PUBLISHED EVERY OTHER SATURDAY

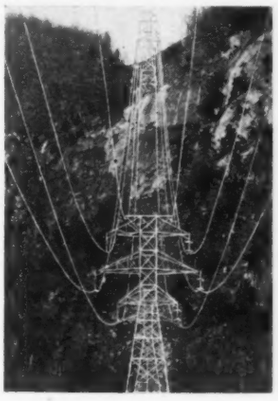
JANUARY 19, 1935

Engineers Seek Professional Status

SIGNIFICANT developments in the status and organization of engineers are occurring. The endeavor is to place the engineering profession on the same plane as those attained by the legal and medical professions. No accurate definition of the engineer has been available and his legal and social standing has been undetermined for many years. Any one can use the title, any school can grant the degree, any one can attempt engineering practice and almost any one can attain membership in engineering societies. It is logical, therefore, to attempt to bring some order into the situation.

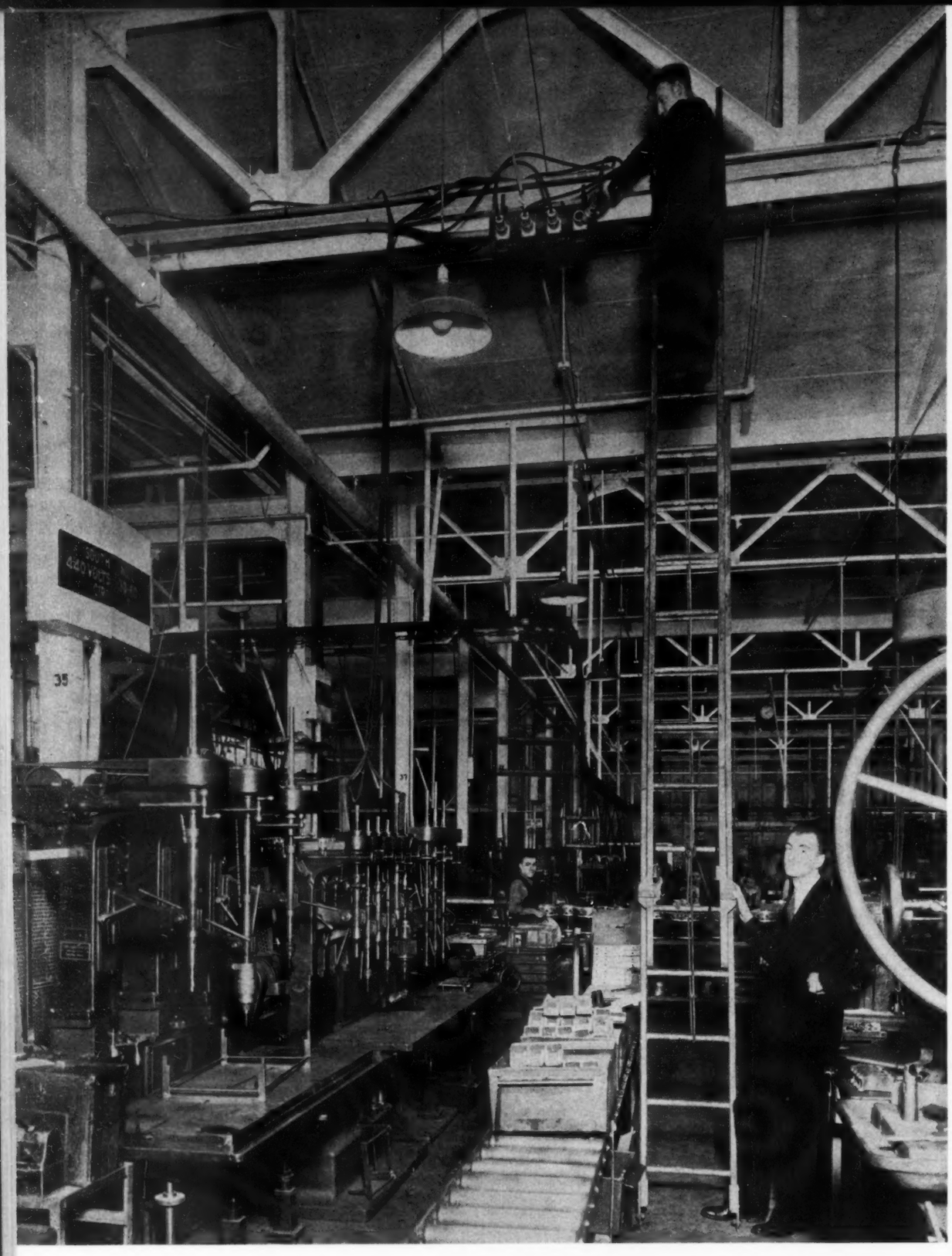
One of the first moves was the attempt to pass legislation in each state defining the engineer, prescribing his qualifications and forcing him to take out a license before he could practice. This forced or legislative endeavor to advance the standards of the profession has grown rapidly, so that some 26 states now have engineering licensing laws. In general, these laws have been strengthened gradually and the qualifications for licensing have been advanced. Enforcement of the laws also is becoming more prevalent. The profession as a whole, as represented by the founder engineering societies, did not initiate this legislative movement and, in fact, was neutral or negative in attitude at first. More recently the societies have given serious attention to this development.

A joint organization called the Engineers Council for Professional Development was organized and has been hard at work for two years on a basic plan to aid the engineering profession. This has been announced and approved by the societies represented on the E.C.P.D. It is an ambitious plan. It starts with ways and means for the selection and guidance of engineering students during college and after graduation. It provides for officially accrediting engineering schools. It specifies uniform requirements for licensing and for membership in professional societies. It attempts to define the engineer in legal and professional terms and to prevent the use of the title by unqualified persons. It seeks to get uniformity and interchangeability in licensing laws and practices. Many of these items in the plan are now being tried out and applied.



ONE of the traits of an engineer is his tenddency to be an individualist and to neglect everything that does not relate to the technical aspects of his work. Many engineers look upon the E.C.P.D. as a glorified and unpractical committee whose operations do not affect them. This is not true. The work of the E.C.P.D. is necessary and vital to the profession and it needs and deserves the wholehearted support of all engineers. It is trying wisely and sanely to advance the professional status of engineers and to counteract any ill-advised political or selfish moves that would be injurious to the profession. The chaos in the professional status of engineers must be reduced to order and present conditions call for quick and positive action to meet the economic, social and political situations confronting the profession.

A parallel movement for professional advancement, proven effective anew last week, is American Engineering Council. This body is more definitely concerned with the external relations of the profession to society and to the government. It focusses engineering knowledge and competency in an organization that acts as a counselor to government and one that can be heard in the development of legislation and political policies affecting public interest. Both the E.C.P.D. and the A.E.C. are indispensable aids in developing and improving professional standards and in securing recognition of the profession. They should be supported by all engineers.



MAKES ELECTRIC SERVICE TRULY FLEXIBLE

Three unobtrusive elements are essential to securing the maximum benefits from electric service in industry: (1) Ample circuits with facilities for convenient connection anywhere; (2) meters and instruments for checking or analyzing departmental or individual operations, and (3) control that adapts application to the process and avoids result of human frailties. Here is a factory where the first requirement has been given more than usual consideration, permitting motor-driven machines or electric heat applications to be connected wherever they may be placed without revamping or extending circuits.

Utilities' Knottiest Problem

Why Propagandists Are So Successful in Developing a Public Following — A Sound Basis for Securing Better Public Relations — Suggests How to Apply Principles

The misinformation and lack of understanding of the principles and problems of utility services among all classes is astounding, and the greater part of the blame for this rests squarely on the shoulders of utility managements who have neglected to develop relations with the public properly.—Chester D. Tripp, speaking as chairman executive committee, American Federation of Utility Investors, Inc.

By WILLARD COPE

Executive Assistant
Public Relations Department,
Philadelphia Electric Company

IF SUCH a situation as that described by Mr. Tripp exists—and his views seem to be shared by virtually all executives of the industry who are quoted for publication—its existence proves clearly that the organized journalistic and political opposition to the present form of the electric light and power business have distinct gifts as dramatists, or engineers, respecting ways to arouse the public's fears and prejudices.

A successful method is always worth examining. It will be valuable to see what method the opposition has been and still is employing so successfully. For example:

> The playmakers know that when you see a man in a silk hat come to grief in a splash of dirty water you are apt to laugh, so they have such things transpire on the stage for your amusement.—*Frank E. White, "Illusion in the Drama."*

The newspaper cartoonists have surely read that one.

The reluctance of all but exceptional human beings to use their power of reason when its exercise can be avoided is a known fact which must be faced frankly. Two authorities emphasize this fact:

> For every four who order their lives . . . by rationally thought-out convictions . . . there are ninety-six who live without order and move only by emotion and sentimentality.—*Dr. George A. Dorsey, "Man's Own Show, Civilization."*

And this final quotation on the point from an acknowledged preceptor, Sir Auckland Geddes:

> In politics, in the affairs with which governments have to deal, it is not accurate knowledge that matters—it is emotion.

The journalists and politicians know these things by a sort of instinct. The former are confronted with selling almost at a glance a new product every few hours to great hordes of individuals, and the latter must sell themselves at frequent intervals to this same largely undiscriminating, emotional mass. Therefore, they have to know in order to survive. And when they go into action—whether it be against a rival political faction, a group of dissentient department stores, a public utility or an opposition newspaper—they resort actively to those methods in which daily experience has schooled them.

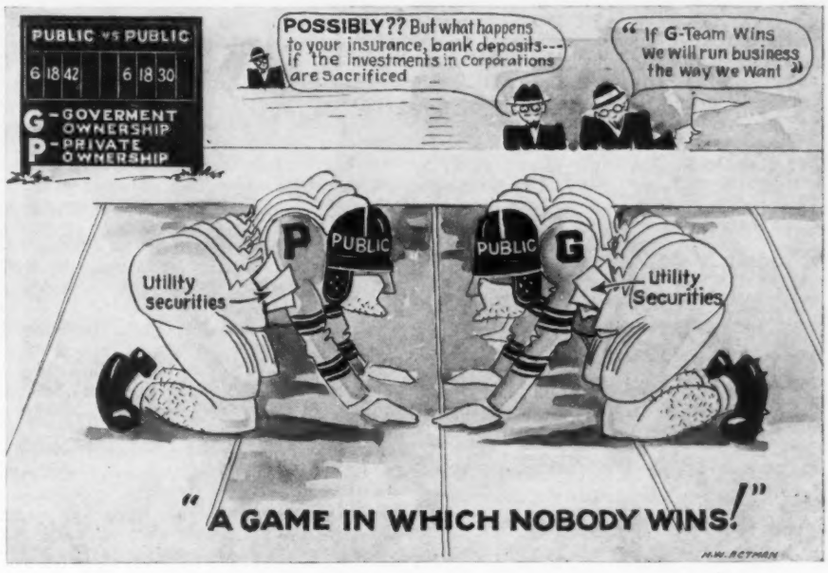
Analyzed, those methods are found to spring from two basic thoughts or principles of approach, one positive, the other negative.

1. Seize the attention of your reader or hearer.

2. Don't rely too much on his reasoning powers; i.e., address the argument to his instinct of self-preservation, more commonly referred to as his self-interest.

Since utilities exist to serve the public, are governed by the public's idea of them as translated into political action and are in the last analysis creations of the public will, it seems desirable — indeed vital — that the scientific or engineering rules of procedure underlying any successful public-relations activity should be better understood in utility circles.

The starting point of such consideration, naturally, should be the composition of the public mind, for that is the essential problem. It is accepted as a working principle that every mind


PUBLIC vs PUBLIC
6 18 42
6 18 30
G - GOVERMENT OWNERSHIP
P - PRIVATE OWNERSHIP
POSSIBLY?? But what happens to your insurance, bank deposits--- if the investments in Corporations are Sacrificed
" If G-Team Wins We will run business the way We Want "
P
PUBLIC
PUBLIC
G
Utility securities
Utility Securities
" A GAME IN WHICH NOBODY WINS! "
H.W. ACTMAN

A cartoon can convey more than a lengthy dissertation

About 103,000,000 voters, who are also direct or indirect investors in the utility industry, are arrayed in opposition to themselves in the national dispute about electric light and power utilities. Just a few bearded philosophers are left in the grandstand. No sensible team plays against itself. How long would a rules committee permitting such a game last? About as long as the goal posts used to last after a championship contest.

has three closely related general divisions, namely, two fundamental instincts and the power of reason. The primary function of the instincts is to preserve the individual. This concern largely occupies the reasoning faculty as well, although there is something "left over"—a certain personal disinterestedness which is said to be the most valuable of human characteristics. The instincts have many qualities far from primitive. The sense of beauty, the love of music and of all of the visual and audible arts are refinements of one of them; industry, thrift, curiosity, inventiveness, caution are among attributes arising from the other. They are a legitimate concern of any public relations program.

How does the successful dramatist manage? To quote White further:

> The playmaker . . . excites your curiosity, he calls up your filial love; he moves you to ardently desire for fair play; he vitalizes your sentimentality; in short, he plays on your emotions as a pianist plays on the keyboard of an instrument, and the response is almost as definite.

A recent analysis of 25 popular books, 25 motion pictures and plays and 25 radio programs—done with the purpose to discover the exact nature of the public's interests—brought these results:

Books—Utterly frivolous, 11; partly significant, 4; genuinely important fiction, 5; serious non-fiction, 5. From this the reading public, as is proper, appears to be a superior section of the whole public.

Motion Pictures and Plays—Without attempting an exact statement of evaluation, since the theatrical arts are notoriously controversial, it can be said that the proportion of instinctive thinking to rational thinking involved was found to be overwhelming.

Radio Programs—The type of thought aroused by nearly all of these programs was the "reverie," which is defined as[1] "escape thinking" or a pleasant running away from the problems of living. The radio is demonstrably the most popular of the three fields and is plainly least addressed to the public's reasoning powers.

A sound basis for appeal to public

It is not possible, of course, to reduce the human personality to exact percentages. There is always something unaccounted for, a something which bears as many names as there are differing philosophies and religions in the world. But for the purposes of this discussion, an approximation may be attempted. From what has been demonstrated it seems justifiable to offer the following general formula:

1. Not less than 50 per cent, and perhaps as much as 80 per cent, of each unit of public relations effort should be employed solely in attracting the attention of the public. That is to say, the advertising copy, the publicity, the speech, the act of policy—the unit of effort, whatever its nature—should concern itself first of all with the public's desire to be entertained, to be amused; technically, "to escape." Of what value is the effort if it doesn't establish contact with the public it is meant to influence?

2. At least 95 per cent of the remainder—that is, the "message" to be conveyed after the public's attention has been gained—should be addressed to the instinct of self-preservation; to the fundamental concern of every human being. This, it will be seen on reflection, offers wide latitude; it permits the recital, in striking ways, of all the points where individual and group welfare is linked to the welfare of the electric light and power industry. It creates the "We" attitude which is the cure of the industry's present difficulties.

3. Only incidentally should the effort be directed to sheer reason. This does not mean that the reason should be offended, or ignored. Rare indeed is the mentality which does not have occasional flashes of pure intelligence. The point is that the unit of effort should be reasonable—that is, should have logical origin and guidance; but should be addressed, first, to the public's desire to be amused, and, second, to its concern for its own economic welfare. It is thus seen that the program has nothing in common with that of the so-called demagogue who considers these latter points only.

Two secondary implications seem to be these: (a) Each message should be held to one central thought, with necessary clarifying discussion, and (b) the whole program should be based on iteration and reiteration, and sustained or linked by some connecting thread. The first makes for ease of understanding, and the second produces a cumulative lasting effect.

What material do utilities have to work with in carrying out this formula? Wherein can they appeal to the public's self-interest after capturing its attention? A virtually interminable list could be drawn.

First of all, self-interest nowadays is in many respects synonymous with money. A troubled population, observing millions on low subsistence levels and not knowing what tomorrow may produce, is not to be blamed if it doesn't want to gamble with the stability of one of its sources of economic strength—namely, the utilities. An estimated 103 millions of them are direct and indirect investors in utilities. This should offer a legitimate field of appeal purely in terms of money—

Economic appeal

Money, in the sense of the public's dollars of investment; not only these investors but all 125 millions of the public are interested in money as represented by the far-reaching payrolls of the utility industry;

Money, as the enormous and greatly varied purchases of utilities with their consequent effect on other industries;

Money, as the taxes paid by utilities which help to make possible the various relief and recovery measures affecting millions of lives;

Money, as the new construction programs of utilities employing thousands;

Money, as the necessary medium of exchange which the utilities are serving constantly to keep in circulation.

It is intrinsically the most powerful of arguments and it is susceptible of just such presentation as is indicated by our formula.

Fortunately for civilization, self-interest also takes other than monetary forms even in times of economic crisis. Thus the public—as occupants of a given area in which they spend their lives and weave their hopes—can be caused to feel a very natural interest in an enterprise such as the electric light and power industry, which performs vital services in relation to all forms of production, distribution, communication, science and health, home-life and entertainment. The oldest sort of self-interest—older even than economics as today defined—is concerned here. It is one with the self-interest of the cave-man or jungle dweller of æons past—ready to battle

For years utilities have been attempting to secure sympathetic public understanding of their policies and practices, so they would be less harassed and handicapped in their efforts to render a public service. Their present state is largely due to their failure to understand the workings of the human mind, which propagandists have known how to utilize.

Based on sound psychology and successful applications of it by politicians, the author presents practicable ways in which utilities can win back public favor without resorting to objectionable methods often used by propagandists, provided they have removed all practices which cannot be justified. Some possible applications of the principles are suggested, but it remains for executives to put them actively to work.

[1]Prof. James Harvey Robinson, "Mind in the Making."

to the death to preserve his fire or his spring.

There is still another sort of self-interest which can be arrayed in behalf of utilities if it is successfully aroused. It is that which the wage-earner, the professional man, the business man must profess in safeguarding his own source of income. It has to do with preserving the present liberated form of economic (and therefore political) organization in which the American people live. The ages-old fight of the common man to escape the chains of despotic government has created in the public a deeply rooted fear of the loss of personal liberty. It has all the force of instinct. This fundamental axis of thought could be employed legitimately in hundreds of ways by the industry in resisting governmental encroachment.

Reflection will make clear that this is far more than a mere line of argument suitable for advertising purposes. It happens to be true. History will show thousands of instances of governmental or political oppression for every instance of oppression by the forces whose curbing now is sought by a return to the older (governmental) ways of restricting initiative. Nor should the use of such ideas be restricted to advertising or publicity techniques. As indicated, the chief application of this new grasp of human motives should be to policy, every form of institutional conduct being decided in the light of established findings as to the nature of the public's motives.

The utilities have all the best of the argument. It is the opposition that proposes experimentation—experimentation of which the public should be dubious, if not resentful, if it were clearly demonstrated that the principles underlying the experiments were antagonistic to the public's own several ways of living and earning an income.

It is thus seen that there is a sound basis of appeal to the public's consideration.

The real question is how to gain the public's attention. This is a task for specialists, for dramatists, so to speak, for writers, for artists. It is a task for men and women who have natural or acquired insight into psychology.

In any event, the specialist in public relations is needed more today than ever before, because the task of compelling the public's attention to the utility's side of the controversy is now more difficult.

How apply the principles?

Where is he to find his material? The answer is that mainly he will create his own material. It lies in his viewpoint, in his creative ability, in his dramatic gifts, in his "touch." He would evolve his own media, his own avenues of approach to the public's consciousness. The electric industry need only supply him its magnificent record of painful and inspiring struggle with a magic force. Witness the instant success of the novel "Slim," by William Wister Haines—a story of a lineman which has become a best-seller at a moment when the industry he works for is somewhat less than popular. There is latent drama in every phase of the industry's life with which to draw the public's attention.

Men have managed to make absorbing reading or drama out of far less interesting basic subjects than the complete transformation of the world's life within a brief period, the reduction of rates and widening of beneficent use through better operating methods, the spreading of financial benefits to millions of persons, the conquest of disease, suffering and death. Maeterlinck took the life-cycle of a bee and made of it a deathless contribution to literature.

There is no subject which cannot be made to appeal with the right approach. For example, it is desirable, at the moment, to remind the public of its huge stake as investors, direct and indirect, in the utility industry. Rather than a lengthy financial treatise which taxes the public's reasoning power, such a cartoon advertisement as that illustrated would be more effective.

The material is at hand. It is all a question of method. The industry has a sound argument to present—a reasonable argument—but it must travel over the available mental paths in delivering that argument to the consciousness of the public. It must gain the public's attention and phrase its justifiable argument in terms which the public "will take to heart."

News!
It is by translating the Electric Industry's often far-away seeming problems into terms and incidents familiar to the daily life of the people that Understanding is most easily and effectively achieved.
Everyone knows that the costs of most necessities of life are rising. It is a matter of daily experience to the Housewife. Certainly it is no secret to the Head of the House.
Yet there is one notable exception — the rates charged for Utility Service. Here, indeed, is NEWS — welcome news! — and as such it is eminently worthy of being passed along to the public. A friend of the average man's pocket-book is a friend indeed. . . .
"ALL OF US MUST LIVE..."
says Ready Kilowatt, your Electrical Servant, "and food and other necessities are costing quite a lot more than they did a year ago."
"But the wages I get from the Public are less than ever.
"Although I work hard, all day and all night, every day in the year, supplying a vital necessity to three million people, I've taken cuts in pay — voluntarily! — every year but one since 1922 . . .
"So I think I'm unique on anybody's pay-roll."
*Latest U. S. Department of Labor figures show that retail food prices in Philadelphia have gone up 20.9 per cent in the last twelve months.
Ready Kilowatt has trained representatives who will gladly show you how little his services cost in performing many tasks in the Household, Factory, Store and Office.
PHILADELPHIA ELECTRIC COMPANY
A Pioneer In Voluntarily Establishing Low Rates For All Electric Service
PHILADELPHIA ELECTRIC COMPANY
A Pioneer in Voluntarily Establishing Low Rates for All Electric Service

(Advertisement from a recent issue of a Philadelphia civic publication.)

Just one example of human-interest appeal

Many other opportunities exist. The whole field of amusement, ranging from Mickey Mouse to the Three Little Pigs, can be drawn upon for presenting the industry's problems to the public without the fatal requirement of demanding laborious mental effort on the part of the public.

Power Plant Cost Reductions

Possibilities Outlined for Capital Cost Reduction by Use of Good Engineering and New Technological Developments—Use of Unit Station Principle Offers the Greatest Gains

The author has been asked to submit an article on "Big Holes for Station Cost Reduction" and to show how the public utilities should build their next additions to system capacity. This is a large order and, unfortunately, no one prescription can be compounded to fit the needs of every patient. Engineers and their executives have, however, a number of tried ingredients to work with and the problem is that of selecting the proper ones to fit the individual case. This article outlines present conditions and suggests approaches to cost reduction.

By FRANK S. CLARK
Consulting Engineer
Stone & Webster Engineering Corporation, Boston, Mass.

UTILITY engineers and executives are paying close attention to capital costs, and rightly so when one considers that the fixed charges on a power station of average cost, operating at 50 per cent capacity factor, will equal the average operating expense. And how many stations have operated at so high a rate of output for a period of, say, ten years? With this in mind it would seem of advantage to consider investment costs and how they are affected by the elements that compose them.

Engineering studies are a necessary preliminary to any power installation. These may be more or less involved, depending on the nature of the installation, but, in any event, they require discussions with the engineers of manufacturers of the more important pieces of equipment. *There has been a tendency in the past on the part of both company and consulting engineers to request complete performance data and proposals on numerous types and sizes of equipment for a number of different operating conditions where, possibly, a more careful analysis of the situation would have reduced the number of studies to be made.*

Manufacturers have been willing to furnish the engineers with the data asked for, but the costs of the analysis, research and development must be recovered in the prices charged for the equipment. The writer knows of at least two instances where careful analyses have resulted in putting up to the manufacturers definite sets of conditions which were met with a minimum of study. On the other hand, during the rush of work which preceded the present stagnation, there has been at least one instance in which a manufacturer has failed to see his equipment as part of a whole picture and has shown a lack of interest in a suggested development which he is now advocating.

Care in use of unit values

In considering the design of a new station, or of an extension to an existing one, it is as unwise to fix an arbitrary figure to shoot at, based on a unit cost per kilowatt of capacity, as it is to aim at a predetermined efficiency of operation. The author and other public utility engineers have attempted to show on various occasions that each installation is a problem unto itself, affected by so many factors, both within and beyond the control of the engineers, as to make indiscriminate comparisons on a unit basis almost useless.

Accounting systems vary, as well as physical and economic conditions, and plant costs in one case may well contain items which are not included or warranted in another situation. *This is not said to discredit statements of low cost plants, but to emphasize the fact that one plant, though its unit cost be greater, may be as well designed and as well suited economically as another whose unit investment is less.* The solution can best be attained by a full knowledge of the operating needs of the individual company or system by a consideration of the probable "use factor" and useful life of the installation, and by proper selection, co-ordination and arrangement of the various equipment to secure the most economical results.

Developments in the art of heat production, absorption and utilization, as evidenced in boiler and turbine plant equipment, present possibilities of investment cost saving which the engineer realizes, but of which existing business and load conditions prevent him and his executives taking full advantage. Greater reliability of operation permits keeping equipment "on the line" for long periods and reduces investment for reserve, particularly in an interconnected system.

Increased rates of fuel consumption, with the concomitant ability to obtain greater steam generation from given boiler surfaces, have reduced investment in and broadened the field of design of heat-absorbing equipment. The fuel-burning and heat-absorbing equipment at the Buzzard Point plant in Washington, D. C., and in the Port Washington station of the Milwaukee Electric Railway & Light Company are recent examples of economical and satisfactory solutions of this problem.

Development of alloy steels and a better understanding of their characteristics under continued high temperature conditions have given assurance in the use of these temperatures. This has been accompanied by increased pressures, permitting an extended use of the more simple regenerative cycle, with resulting decreased steam requirement per unit of electrical output and a consequent smaller investment in heat-absorbing equipment. This in-

crease in permissible temperature and pressure opens also wide possibilities in the rehabilitation of existing lower pressure plants and in the sale of exhaust or bled steam to industries with the production of electrical energy as a so-called by-product.

The effect of these developments of greater reliability, increased rates of fuel consumption and higher steam temperatures has made feasible the installation of one boiler per turbo-generator, with the added advantages of simplification in piping systems, fuel handling and decreased number of auxiliaries and space requirements, together with unified control of operation. *In the author's opinion this unit arrangement offers the greatest possibility for investment cost reduction.* The Port Washington station on this basis, and with an 80,000-kw. turbo-generator, is the largest development to date and other larger ones are in contemplation.

Economics of turbo-generators

The turbo-generator is the most important of the heat-utilizing equipment in a steam power station. It is also the greatest single item of investment, varying from 13 to 20 per cent of the total structural cost. Earlier limitations of generator capacities imposed by field design characteristics have been overcome, and it is possible now to obtain generators rated at 250,000 kva. in tandem-compound, single-shaft units running at 1,800 r.p.m. This results in a less expensive, more compact and more easily operated arrangement than the former cross-compound units and also requires considerably less space both for the unit itself and for proper operation and maintenance.

Progress is being made in the design of 3,600-r.p.m. turbo-generators, the limit of capacity being now about 35,000 kw. These are lighter, more efficient, require less space and should be less expensive than equivalent 1,800-r.p.m. units. The largest units of this type installed at present are of 18,000-kw. capacity.

The so-called "leaving loss" has an important bearing on the capacity and cost of a turbo-generator, but, due to the former striving for increased thermal efficiency, its economic aspect has been somewhat lost sight of. "Leaving loss" is defined as the residual kinetic energy in the steam as it leaves the last row of turbine blades, and in the quest for higher efficiencies it has been usual to design turbines for a minimum loss at maximum vacuum and at maximum load. The former is dependent on condensing water temperature and is a minimum with coldest water, which is usually available for only comparatively short periods in the winter months. Maximum load conditions obtain for varying periods, according to the plant or system load curve. The two conditions are not always coincident. *It follows, therefore, that to obtain the most economic result, instead of striving for maximum efficiency, the turbo-generator should be studied in its relation to the load duration curves, to the temperatures of condensing water corresponding to these curves and to the effect of thermal efficiency on fuel cost.* While the extraction of steam from the stages of a turbine cannot be judged wholly from the economies and the investments for bleeder heaters, the trend toward higher pressures and temperatures has increased the efficiency of the regenerative cycle and has permitted the turbine manufacturer to obtain greater capacities from existing turbine frames, or, conversely, to build units of greater capacities with moderate proportions. The acceptance of higher leaving losses will increase these possibilities and should result in a reduction in investment cost per unit of output.

In addition to their effect on the choice of turbo-generator, the results of the studies and trends mentioned in the preceding paragraph, together with improved arrangement and spacing and smaller diameters of tubes giving higher rates of heat transfer, should permit the selection of smaller condensing units with a decrease in investment required.

Costs fixed by locations and structures

The foregoing paragraphs have dealt with elements that are to a great extent under the control of the designing engineer, where choice affects operating efficiency, and are dependent largely upon the economic results to be obtained. Structural items do not affect efficiencies, *per se*, but impose certain conditions which the designer has to meet. Soil conditions affect the type and costs of substructure, as do excessive variations in water level, whether periodic, as on tidal waters, or occasional, as on rivers. These costs may vary from 12.5 per cent of the total building cost in the case of one large building, with ideal soil conditions and practically no water level variation, to 32.5 per cent in another case, where expensive foundations were required and where the variation in water level was 35 ft. In the Ohio and Mississippi Valleys the ratio is probably higher still.

Preparation of the station site is an item more or less imposed upon the designer and may vary from 0.5 to 3.75 per cent of the total structural cost. The first figure is for a station of large capacity and the second for one of approximately one-third as large, the cost for the latter being actually $70,000 greater than the former. Stations receiving their fuel by water, especially in large capacity steamers, require heavy expenditures for wharves and dredging, and in the case of coal, for quick unloading and storage facilities. These items form a much larger percentage of cost than they do where rail delivery is made or in the case where liquid and gaseous fuels are piped to the site. The dragline scraper has become an accepted method for handling coal into and from storage, whether delivery be by water or rail. The system is flexible, sufficiently rapid for the largest stations and much less expensive than the older traveling bridge method.

Condensing water facilities form an appreciable item of cost which varies considerably in amount with different situations. *It is suggested here that it may prove less expensive in some instances to consolidate pumping facilities for several units in a single screen house, using pipes to convey the water to and from the condensers instead of costly subfoundation concrete tunnels.*

Savings in original investment and in the costs of future additions to plant structures and equipment can be effected by constructing only such portions as are needed for the immediate load requirements. *Experience has shown the folly and expense of trying to anticipate the trend of the art of power station design and the capacities of equipment for future load conditions.* There are instances of structures having been provided initially for future needs which, when these needs arose, have proved totally unsuited for the purpose. Such provisions hamper the engineer in his design, involve needless initial investment, increased fixed charges, and waste of money for changes in structure when the times for their utilization have arrived.

Much has been said recently about doing away with the power station walls and roof, leaving the equipment exposed and housing in only those portions essential to the normal operating functions of the station. An approach to this arrangement is now in operation at Schenectady, and serious study has been given to it by several operating companies and consulting engineers. Cost of superstructure, in addition to walls and roofs, includes such items as floors, walkways, stairs, service equipment, interior partitions and structural steelwork, which latter serves to support boilers, coal bunkers and smaller equipment. A recent subcommittee report on "Power Station Building Costs," published in the May, 1934, issue of Edison Electric Institute *Bulletin*, states that walls and roofs represent, on an average, 25 per cent of the superstructure cost. This latter item represents from 12 to 15 per cent of the total cost of a plant and will become less if the unit arrangement of one boiler per turbo-generator is adopted.

Therefore it would appear from this that a maximum saving of 3 per cent may be possible if the "outdoor type" station were built. One manufacturer advances the idea that a study of the possibilities of placing equipment outdoors may result in the betterment of the apparatus and possibly in decreasing its cost. This type of station involves problems in operation and maintenance and provision against freezing in cold climates, which must be considered before deciding if the saving is offset by the operating problems introduced.

However, there are evidences of a decided tendency toward the omission of interior walls and partitions and a more compact arrangement of equipment, which will result in reduced building costs. The subcommittee named above advances the belief that "building costs can be reduced materially without too great sacrifice of pleasing appearance and none at all of fitness or adequacy for the real purpose of the plant."

Rehabilitating old stations

There is much talk nowadays of rehabilitating old plants by superposing high-pressure boilers and turbines, and there are at least two instances of this having been done. These stations have distribution facilities already provided and such an installation utilizes existing plant facilities to a greater or less extent, being somewhat analogous in this respect to a station extension.

The "superposition" method provides additional capacity and effects operating efficiencies. It is probable that the capacity can be obtained at a less unit cost than it could be in a new station, but in relation to the extension of an existing one the result may be close. Do not forget also that

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Evaluate Costs of

1. **Engineering negotiations.**
2. **Unit cost to entire system.**
3. **Economic instead of thermal efficiency.**
4. **Elimination of reserves and accessories.**
5. **Trying to anticipate future additions.**
6. **Rehabilitating old stations.**
7. **Joint power and steam service.**
8. **Outdoor structures and gear.**
9. **Departure from unit principle.**
10. **Use of new equipment and ideas.**

•

in removing old steam-generating equipment you are in some cases destroying investment which is valuable for low-capacity factor, peak-load service. Also, in considering efficiencies the fact may be that the load to be carried by the rehabilitated plant may be handled by some existing station at the same or a lower increment cost. This is not intended to throw cold water on a promising method of effecting economies, but to emphasize some of the factors involved.

It is to be recognized also that the efficiency of heat utilization of the existing equipment is not improved by superposing high pressure, and its retention must be considered in the light of the improved efficiencies of modern equipment through the same pressure and temperature ranges. One company has considered it economical to rebuild its turbines to take advantage of this added efficiency.

Another form of rehabilitation which should not be lost sight of is the remodeling of existing equipment to obtain both greater capacity and better efficiency. Availability of equipment to produce higher combustion rates makes possible increased steam output from present boilers, and remodeling, rebuilding and in some cases replacing turbo-generators provide additional generating capacity and some betterment in efficiency as well. In certain instances this method of rehabilitation may prove well worth while, as it has done already in several plants, Columbia and West End stations in Cincinnati being notable examples.

The previous discussion has dealt with ways and means that have been tried and found to be both feasible and economical. The use of 650-lb. pressure and 850 deg. F. temperature has proved to be satisfactory in operation and the increment cost over 450 lb. and 750 deg. F. steam has been sufficiently small to be justified economically. Some future installations, principally of superposed units, are planned for 1,200 lb. and 910 deg. F. steam conditions. These seem justified from an operating standpoint by the fact that there is confidence in the ability of materials available to stand up under the increased temperature conditions and that no complication in heat cycle is involved. The investment costs as yet are based solely on estimates, which, however, should be accurate.

Mercury vapor boilers and turbines are in commercial operation in three different stations. The combined mercury and steam cycles indicate a possible improvement in efficiency of about 20 per cent over the best of the steam plants today. While the investment costs for the existing installations are known to the companies having installed them, the special character of the installations and the present lack of commercial standardization do not give as yet an accurate indication of their economic worth. However, the development should be watched.

"Critical pressure," or 3,200-lb. pressure, boilers are in operation abroad, and recently one American turbine manufacturer has acquired the rights to manufacture this boiler in the United States. It is not commercially available at the present time, but the intention to develop it for variable pressure operation, in conjunction with a steam turbine, has possibilities of efficient operation through a wide range of load.

The sale of steam, as well as electric power, to industries which have a need for such combined service offers, in some instances, possibilities for economical power production. Increase in steam pressure and temperature has made possible to the industries the production of electric power as a "by-product" of their steam requirements and in some instances utilities are

faced with the possible loss of present industrial power loads. This is particularly true in cases where existing low-pressure industrial boiler plants are old and must be replaced. The author realizes that the desirability of furnishing such combined service, particularly where it requires a considerable investment, is dependent upon numerous considerations not of an engineering nature. The threat is a real one, however, and the fact that there are a number of cases where the dual service is being furnished with satisfaction to both parties warrants more than a superficial investigation.

Saving in electrical costs

While electrical equipment may not represent a large percentage of the total cost of a station, and its efficiencies have attained a value close to 100 per cent, there is, nevertheless, opportunity to reduce the investment for this portion of the plant.

Hydrogen cooling has been used successfully for large frequency changers and is available for turbo-generators, although rarely used at the present time. This method permits of larger capacities with given generator frames and, according to the manufacturers, at no increase in unit cost. Increased efficiencies, together with reduction in space requirements per unit of output, may make its adoption worth considering.

Considerable saving may be effected in switching equipment. *Under certain conditions outdoor metal-clad switchgear should be more economical than indoor switching with its associated building.* Metal-clad switchgear should be, by now, sufficiently standardized to increase its economical scope. Irrespective of the type of switchgear, there appears little justification for more than one oil circuit breaker per circuit, especially on feeders, or for switching both at generator voltage and at a higher voltage where the distribution is at one or the other voltages.

In stations where the power is distributed at a higher voltage than is generated saving in generator cost can be effected by permitting the manufacturer to determine the optimum voltage.

There are often too many instruments installed on a circuit, some of which are seldom used and could easily be dispensed with. The use of miniature control boards results in considerable savings in space, conduit and wire. Savings can be effected by carefully locating equipment, such as line relays and watt-hour meters, near the oil circuit breakers or instrument transformers, instead of at the control board. The conduit system should be so designed that conduits for future circuits need not be installed initially.

Where feeder reactors are used the oil circuit breakers should be selected for a duty corresponding to a fault on the line side instead of on the bus side of the reactors. This reduces the cost of not only the breakers but also their structures.

Savings can be effected by avoiding undue duplication of protective features. Where a bus is installed in a non-metallic structure, such as brick or soapstone, and bus protective relays are used, there appears to be little justification for insulating the bus. Also, where insulated conductors are used and are out of reach, transite or similar doors, and in many cases phase barriers, appear to be unnecessary.

Electric drive is used almost universally for station auxiliaries, particularly in the high steam pressure stations. In some cases, however, speed control of motors has proved expensive. It is possible in many cases to reduce the cost of speed control by designing mechanical equipment to limit the speed range by the use of mechanical damper control or by the installation of variable speed hydraulic couplings. There is also the possibility in the future that the use of variable speed motors using electronic tubes may prove economical.

Metal-clad switchgear makes it possible to locate the switching for auxiliaries at a more central point and eliminate a special room for it. This results in a saving in wire, conduit and building costs.

Examples of cost reduction

To illustrate some of the points which have been made, the following data are given applying to plants of appreciable size (70,000 kw. and upward). Each has steam-generating capacity sufficient for the full electric output. The author appreciates that costs on the basis of installed capacity are not usually a very satisfactory yardstick, but in these instances they are peculiarly applicable.

The heat-generating and absorbing equipment in a plant of eight boilers costs about $12.35 per kilowatt, and in one of two boilers $6.60 per kilowatt, the former serving three and the latter two turbines. The total electric generating capacities are about equal, although the latter steam pressure is almost double the former. The piping systems in the two instances cost $5.20 and $3.55 per kilowatt, respectively. Condensers cost $5.50 and $1.80 per kilowatt and the buildings $16.50 and $10.10 per kilowatt. At both locations the foundation conditions were excellent, but at the former site the substructure amounted to 17.5 per cent of the total building cost, due to excessive differences in water levels. Possibly 10 per cent should be added to the lower costs to account for differences in price levels. Had piles been required in the latter case, the cost of the substructure, which was 13.0 per cent of the total building, would have been doubled. These figures indicate some of the possibilities of saving due to the unit arrangement.

In a much larger station, with five boilers and two turbo-generators, the heat-generating and absorbing equipment amounted to about $10 and the building to $12 per kilowatt. In this case, where extremely difficult foundation conditions were encountered, the substructure represented 27.5 per cent of the building cost, but the large capacities of the boiler and turbine units served to keep down the unit cost. Condensing water tunnels and wells cost about $5 per kilowatt, as compared with $2 per kilowatt in two stations of less capacities but where simpler arrangements were possible.

Coal unloading and storage facilities, where water delivery is made, cost more than $4 per kilowatt in one instance. In addition, there was required an investment of more than $7 per kilowatt for dredging and wharf construction. In contrast to this is a plant of the same generating capacity where rail delivery of coal is made. The unloading and storage system cost 55 cents per kilowatt, with no expense for dredging or wharf facilities.

Conclusion favors unit idea

The author has attempted to show some of the factors to be considered in reducing investment costs and their effects on the same. To reiterate and emphasize in closing, it is his opinion that the greatest possibility in this line lies in a simple unit arrangement, combined with a careful analysis of the necessity for duplicating any piece of auxiliary equipment, and of the economic value of each item of heat generating, absorbing and utilizing apparatus.

Pulp-Mill Load Control Pays

Whether a factory generates its own power, buys part or purchases all, avoidance of peak loads and maintenance of a high plant factor are desirable. It is low load factor that is chiefly responsible for high operating costs. One way in which an industrial concern can avoid the penalizing effect of peak loads without upsetting plant operation is presented here by an industrial engineer.

By W. D. RIGG
Electrical Engineer
Longview (Wash.) Fibre Company

WITH certain processes, notably pulp and paper manufacture, the use and arrangement of mill equipment are readily adapted to the control of the mill peak demand. The control of power peaks is particularly feasible because the grinder load usually constitutes a large percentage of the total mill load—25 per cent in the case of the Longview (Wash.) Fibre Company. Furthermore, the grinders in pulp and paper manufacture are usually equipped with individual load regulators to maintain a substantially uniform grinding friction and thereby a uniform quality of ground wood as well as a uniform motor load. This individual regulation on the grinder motors simplifies over-all mill power control as the grinding load can be reduced when demands in other parts of the mill become high.

The Longview Fibre Company employs the Meyer system of grinder load control and in addition has a master load controller of the same manufacture to limit the peak demands for power. The control and regulating equipment consists of two distinct parts: (1) The individual grinder-load regulators, one for each line of grinders, which maintain uniform grinding conditions when the demand is less than 12,000 kw.; (2) a master control superimposed on the load regulators which automatically reduces the grinder load when the total mill demand has a tendency to go beyond the 12,000 kw., and maintains maximum load when the total load tends to drop below this value.

Relation of regulators to master control

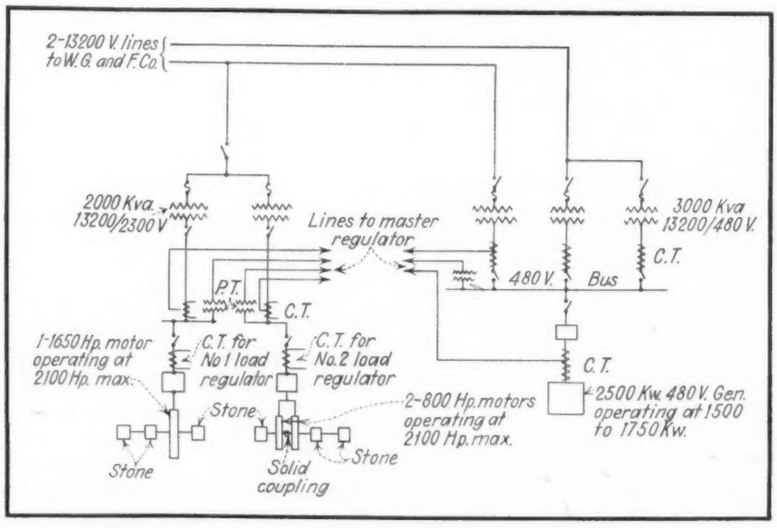
The primary function of the grinder-load regulator (to maintain substantially uniform grinding friction and quality of ground wood) may be handicapped somewhat by using the regulator as a power-demand regulator. Such usage will result in varying grinder pressures, especially if the mill load is of a rapidly fluctuating nature. However, where the mill load increases or decreases by definite amounts and for any extended periods of time, the grinding pressure may be held at a reasonable constant value by adding or subtracting the number of wood pockets in use.

Grinding equipment of the Longview Fibre Company consists of two lines of grinders, each having three 24x54-in. stones with three pockets per stone driven by a 1,600-hp., 257-r.p.m. unity-power-factor synchronous motor. By means of a cooling system on each motor it is possible to work them continuously at 2,000 hp., or approximately 1,500 kw. This makes a total possible grinder load of 3,000 kw. The average load in the remainder of the mill is approximately 9,000 kw., making a total of 12,000 kw. By setting the control equipment at this value, full production from the mill may be assumed without exceeding a 12,000-kw. peak.

When the load is normal the magnet of each individual grinder-load regulator (illustrated and described) exerts a pull just sufficient to hold the pilot valve in a position to maintain the proper pressure on the main-valve diaphragm for carrying a grinder pressure corresponding to the normal motor load. If grinding conditions change, the magnet pull is changed, altering the position of the pilot valve and, therefore, the pressure on the diaphragm of the main valve, causing a compensating change in grinding pressure to bring the motor load substantially back to normal.

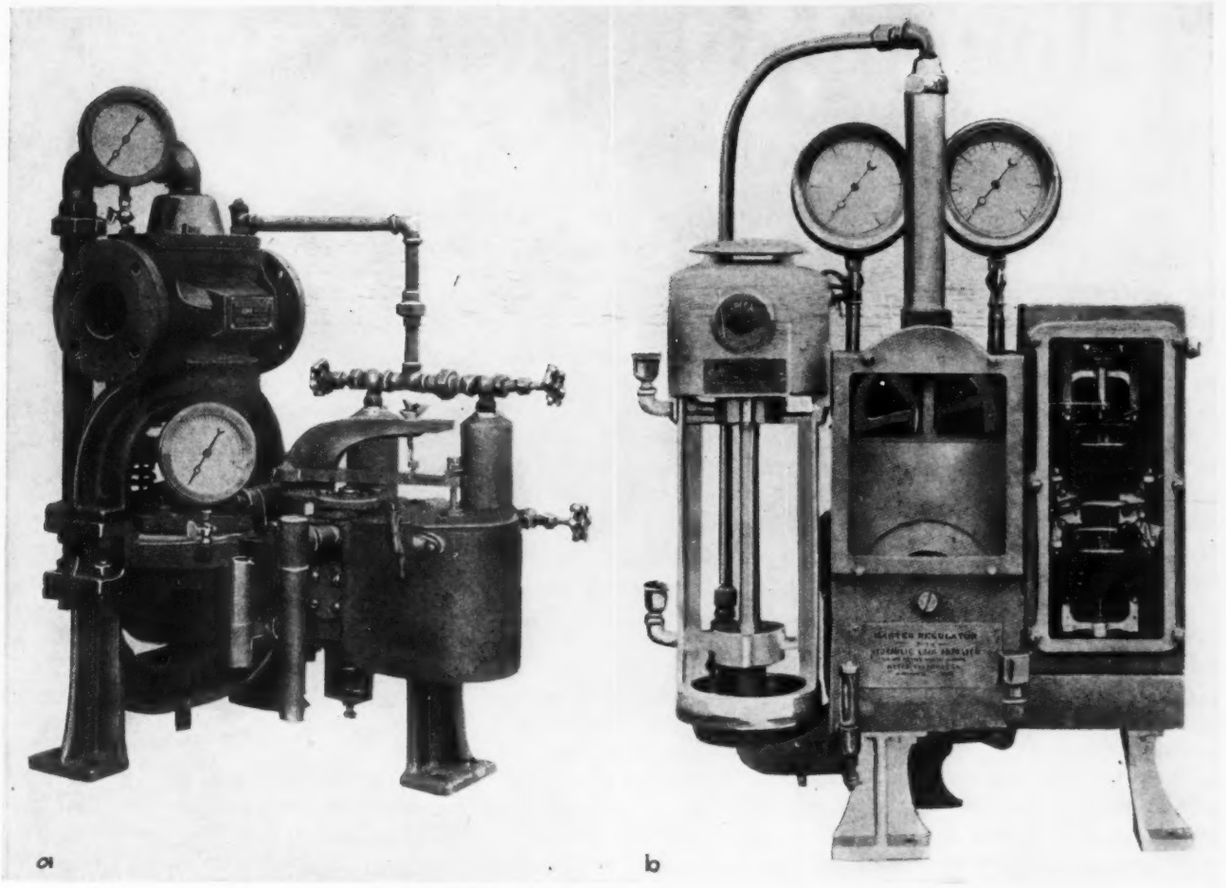
To control the mill demand the master regulator (also illustrated and described) superimposes its operation over that of the individual load regulators.

If it is desired to hand-set the grinder power below a point which is being maintained by the master regulator, this may be done. Conversely, if the master regulator tends to reduce the motor load below the hand setting, this readily takes place. However, the master regulator cannot raise the motor load above the point at which


2-13200 V. lines to W. G. and F. Co.
2000 Kva. 13200/2300 V
Lines to master regulator
3000 Kva 13200/480 V.
C.T.
480 V. Bus
P.T.
C.T.
1-1650 Hp. motor operating at 2100 Hp. max.
C.T. for No. 1 load regulator
C.T. for No. 2 load regulator
C.T.
2500 Kw. 480 V. Gen. operating at 1500 to 1750 Kw.
Stone
2-800 Hp. motors operating at 2100 Hp. max.
Stone
Stone
Solid coupling

How mill peak is avoided by regulating grinder loads

The three transformer banks on the right operate in parallel and divide load evenly so only one set of instrument transformers is needed for the regulator.



Load regulator for grinder line and master control with no moving contacts limits mill peaks

(a) Each of the individual load regulators consists of three main parts; The main valve unit, the pilot unit and a current transformer in one of the motor leads. The pilot unit consists of an oil-immersed, water-cooled, solenoid-type magnet, inlet and outlet pilot valves, a mechanism connecting the pilot valves with the solenoid plunger and a centrifugal pump supplying a constant pressure of about 30 lb. to the inlets of both pilot valves. The pilot valves are balanced and increase the inlet pressure at the same time the outlet pressure is being decreased, and vice versa. This action requires a minimum of travel for the entire range of regulating pressure. The main-valve unit is actuated by a diaphragm, the pressure against which is controlled by the previously described pilot valves.

The individual grinder-load regulator operates in the following manner: The current transformer delivers to the solenoid current proportional to the motor current. Solenoid exerts a pull of from 6 to 8 lb. on the end of a lever and is opposed by a spring. Changing the tension will change the motor load. At a point about one-third the length of the lever from its fulcrum is the pilot-valve stem.

(b) Pull of the wattmeter elements in each power supply line, proportional to the total mill load, is opposed by a weighted lever, the operating length of which is changed to adjust the desired total load. The mechanical linkage which connects all of the wattmeter elements is joined to a pendant tube flexibly connected to the water system of a small recirculating pump. At normal load the jet of water issuing from the tube discharges into a neutral passage and back to the pump. If the mill load increases, the wattmeter elements deflect the tube and cause the issuing jet to flow down a passageway into and against the buckets of a small waterwheel, causing it to rotate in one direction. A small load change deflects the tube a small amount and allows only a small portion of the jet to impinge on the waterwheel, causing slow rotation. Sudden load changes do not cause any action of the waterwheel, but persistent small changes cause a small amount of water to be deflected into the buckets of the waterwheel, where it accumulates until the wheel makes a partial turn.

By means of a gear train the waterwheel causes the slow adjustment of a pilot valve, whereby a water pressure, proportional to the load which the master regulator determines that the grinder motors should carry, is maintained in the hydraulic load adjusters of the individual load regulators.

The hydraulic load adjusters consist of disks with diaphragms upon which the load-adjusting pressure acts. Attached to each disk is a rod from which the magnet spring is suspended, so the hydraulic load adjuster takes the place of the hand screw with which the motor load is manually adjusted.

it is set by hand. This protects against motor overload or excessive pressure on the stones when it is desired to maintain a low grinding pressure, because a stone is new, cold or for any other reason. Each adjustment may also be made so that different loads can be carried on the two grinder lines if desired. Yet both lines can share, on a percentage basis, in all grinder load changes made by the master regulator.

Electrical load in this mill is supplied from two sources: (1) Our own 2,500-kw. turbo-generator and (2) two transmission lines and corresponding transformer banks bringing power from the Washington Gas & Electric Company.

During periods of maximum mill production our demand may be set at 12,000 kw. and it will never be exceeded. There are times when the regulator will reduce our grinder load by as much as 500 kw. under such a setting, but there is sufficient grinder capacity to compensate for this during off-peak periods. During the months of curtailed mill production our demand may be set as low as 11,000 kw., and this value maintained as long as the mill operation allows the lower setting.

The best application of such a regulator is for standby use to prevent high peaks, rather than trying to maintain a constant mill load at all times. The reason for this is that with such usage there is less interference with the grinder operation and a better grade of pulp is manufactured. Also, there is less changing of the number of wood pockets in use to correspond to the water pressure being maintained.

Humanizing the Kilowatt

Seven Power Companies Have Now Adopted "Reddy Kilowatt" as a Symbol for Electric Service With Interesting Results

WHEN a woman buys peaches she feels them and she smells them. If they are soft and have an aroma she knows they are good. She picks out canned stuff by the label, silk by its looks and the feel. And always it is something visible, tangible, something she can appraise out of her experience. But when it comes to electricity, she is lost. What she buys is mysteriously hidden from her sight. And this fact has always made electricity hard to sell. And probably always will.

The phonograph has had its Victor dog, General Motors cars their Fisher coach emblem, Old Dutch cleanser its little woman in the sunbonnet and Smith cough drops their whiskers. And all around us, day by day, we see the familiar trademarks of the commodities and services that we rely upon. But nothing reminds us of the kilowatt in any friendly way. It may be that "it is as though there stood behind the wall servants on tiptoe to spring forth at our summons," as Preston Arkwright put it, but they are still out of sight—the servant nobody knows. And electrical men with their queer curves and technical jargon have just mixed up the mystery. The industry has realized it, but never knows just what to do.

It is a matter of some interest, therefore, that seven power companies have recently adopted a trademark for electric service. It is an effort to establish an appealing personality as the symbol of electric service; in a word, to humanize the kilowatt and make it mean something warm, friendly and interesting to the men, women and children of the communities they serve. This emblem is "Reddy Kilowatt," the brain child of Ash Collins, formerly commercial manager of the Alabama Power Company and now managing director of the Alabama Industries Association. It has now been adopted by the Philadelphia Electric, Pennsylvania Power & Light, Ohio Edison, Tennessee Electric Power, Southern Indiana Gas & Electric, South Carolina Power and Alabama Power companies.

Collins conceived the idea of a whimsical figure with body, arms and legs of zigzag lighting and a round head with a shining lamp bulb for a nose and convenience outlets for ears. He thought that such a figure could personify this ubiquitous and versatile electric servant that electrical men rave about, but John and Mary have never really taken to their hearts. He proceeded to develop the idea and its application to advertising, window display and other forms of power company promotion, establishing distinctive character through rhymes and jingles, tying "Reddy Kilowatt" into all the intimate services that modern electricity can render in the home.

The Philadelphia Electric Company was the first to take on this symbol of the working kilowatt, though, with the traditional dignity of the City of Brotherly Love, it has given him the more formal appellation of "Ready

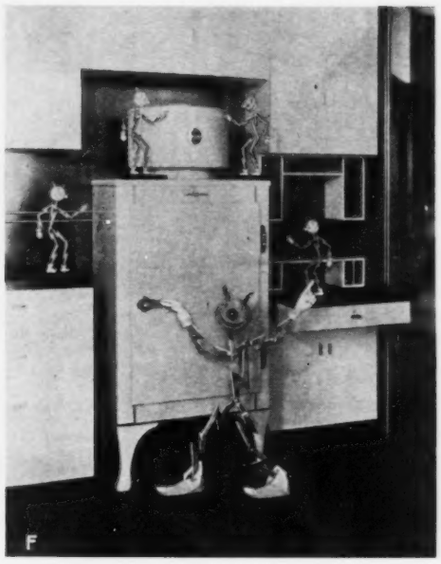
(a) In Alabama "Reddy Kilowatt" is used to humanize the monthly bill, by giving it the significance of a charge for so many hours of work by the electric servant.

(b) In the Tennessee rhyme contest each contestant was also sent a lamp bulb tied to this label, as an acknowledgment.

(c) One of the advertisements featuring a verse contributed by a consumer in a "Reddy Kilowatt" rhyme contest. The company paid $2 for each rhyme published.

(d) An introductory ad used by the Ohio Edison Company shows "Reddy Kilowatt" coming out for a convenient outlet.

E



F

(E) A window display in Philadelphia showing how "Ready Kilowatt" is featured as an element of human interest. (F) Pennsylvania Power & Light uses the metal mannikins this way in its display rooms

Kilowatt." The others followed, and the accompanying illustrations show how this intriguing little figure is being used.

In Tennessee the company has run a "Reddy Kilowatt" rhyme contest, in which it pays $2 for each rhyme that is accepted. It is attracting much interest and sets the children to pestering their parents to tell them how electricity helps them in the home. These are being published in the newspapers, many of them signed by married women.

In Alabama the symbol is featured in the monthly bills, so that instead of reading in cold kilowatts the bill tells the customers that "Reddy Kilowatt" worked so many hours for them last month. It is a nice touch. In Philadelphia this little figure is used cleverly in window displays and a marionette show in which, after a demonstration of the care and burden of old time housekeeping, "Reddy Kilowatt" shows a modern housekeeper how to do it electrically.

In the Pennsylvania Power & Light territory the company set it up with an elaborate program. It interviewed all newspapers, sold the idea in employee meetings, ran teaser ads and then ushered in "Reddy Kilowatt" with the limelight square on him, featuring him as a trademark and a friendly representative in a variety of applications.

Results are, of course, indefinite as in all advertising. But the idea has clicked with John and Mary. Letters come in saying: "Ask 'Reddy Kilowatt' to turn our current off on Saturday. We're going away on our vacation." Or "Tell 'Reddy Kilowatt' to turn our lights on again. We will be home on Monday." Customers phoning in mention "Reddy Kilowatt." The company employees like the idea. The professional reaction of local newspaper and advertising men has been good.

Altogether it is a smart idea. And apparently it works. Ash Collins has made a valuable contribution. The beauty of it is that it fits in any part of the country and can be used by any number of companies, because it becomes a local symbol wherever it is adopted. If it should become a national symbol, so much the better.

Saves With Capacitors

With rising output the load factor favored retaining group drive against heavy outlay for individual motors — Combines two circuits on 300-kva. condenser and gets better rate on one meter

By G. H. LINEBERRY . . . T. F. STRADLEY

Sales Engineers,
Iron City Electric Company Raphael Electric Company
Pittsburgh, Pa.

IN ITS search for lower operating costs the Pittsburgh Equitable Meter Company instituted such economies as were possible in the use of machines, but found that only negligible savings resulted. It then asked the power company serving it to survey its electrical equipment and to make any suggestions that were indicated leading to economy. The power company's engineers, getting costs on labor and materials from an electrical contractor, made a thorough analysis and found an interesting condition which led to a corrective installation.

The load was served by two lines from the 22-kv., three-phase, 60-cycle bus. One line served a battery of arc furnaces at 4,000 volts through a 600-kva. bank connected in star on the secondary with the neutral carried through to secure 2,300-volt, single-phase power for the furnace transformers. This bank, showing an average power factor of about 55 per cent, was owned by the meter company and was metered (including demand) on the primary side (Fig. 1). The other line served the motor circuit through a 300-kva. bank, 22,000/220 volts, three phase. This bank, showing an average power factor of about 53 per cent, was owned by the power company and was metered on the secondary side.

The extremely low power factor on the circuit serving the general motor load indicated that a study might well

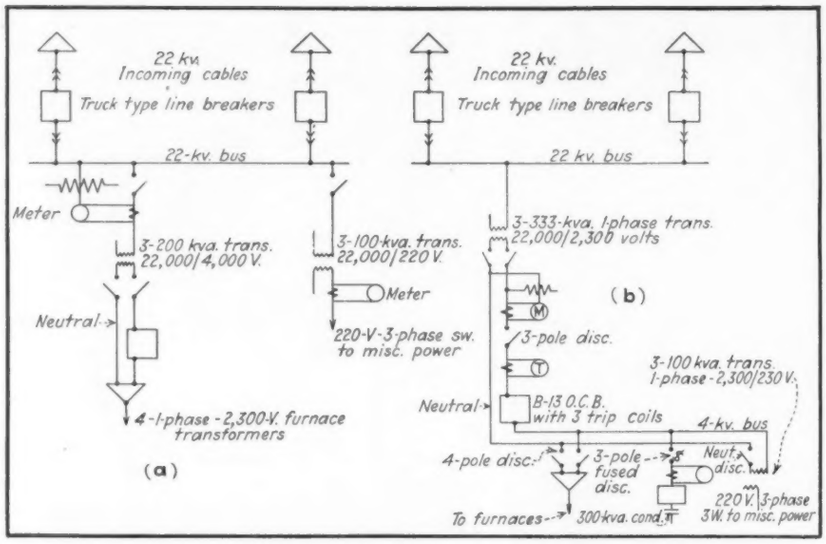


Fig. 1—Capacitors installed incidental to revamping industrial substation
(a) Original layout divided service metering and responsibility for 22-kv. equipment. (b) New layout consolidates metering and relieves customer of high-tension responsibilities.

be made of this circuit. It was expected that machines would prove to be overmotored and that the line shaft drives would show a poor load factor. These conditions were found, as suspected, but no particular increase in plant efficiency could be gained by shifting of motors. The types and magnitudes of motor loads did not lend themselves in a single instance to the shifting of the installed motor from one load to another so attention was turned to the line-shaft drives.

Changing machines from line shaft to individual drives would have shown a considerable and worth-while saving under present conditions, but would have necessitated a considerable outlay in material and labor incident to the changeover. A balance struck between cost and result indicated that the machines being used should be individually driven, but at this point another factor entered the calculation. It had been found that the nature of the work done in the plant prohibited straight line production. Thus, at low production, the load factor and diversity factor on the line-shaft drives were very poor. Calculations showed that, due to the inherent nature of the machine load, a considerably better power factor and efficiency could be expected from line-shaft motors under increased production. These considerations led to a decision against a change to individual drive in this particular case. It is interesting to note that the expected increase in production has been realized since and results show very clearly the wisdom of this decision.

Thus it was found (1) that conditions warranted no change on one line and (2) that it was manifestly impossible to change the nature of the arc furnace load on the other circuit. What then?

Services consolidated, capacitors added

The company's primary service was as shown in Fig. 1 and offered obvious opportunity for economical change. Under the existing arrangements the company was purchasing its electrical requirements under two schedules, one for furnace load and one for the general power and lighting. It was found that a substantial saving could be made by combining these two services at one voltage and under one rate.

Fig. 2—Circuit breaker housed integrally with capacitors
Delon disconnecting fuses were installed between the capacitor breaker and the bus for disconnecting purposes and short-circuit protection in case of cable or breaker trouble.

Inasmuch as neither the meter company's 600-kva., 22,000/220-volt bank nor the power company's 300-kva., 22,000/4,000-volt bank could be utilized to serve the whole plant it was necessary to secure a larger main bank of transformers and a sub-bank to supply the general power load. This would allow the metering to be done at one point, the secondary of the main supply bank.

Arrangements were made for the purchase from the power company of the high-tension equipment in the substation. The meter company purchased a 4,000/220-volt bank for general power and the power company furnished a main supply transformer. The equipment was installed as shown in Fig. 2 with the neutral carried through for use in an emergency during which two of the general power transformers might be used in open delta.

Power-factor studies already made indicated that a 300-kva. capacitor would improve the power factory of the total load to near unity. Such a unit (capacitor and circuit breaker unit) was installed. The following advantages are immediately apparent:

The company has new wiring in its transformer room and a better arrangement of its equipment. It is relieved of the responsibility of maintaining a 22-kv. service and no longer has the very real hazard existing when 22 kv. is handled by workmen who may not be thoroughly trained and whose experience in such work is only occasional.

The changing of the metering set-up and the installation of capacitors gives the company the advantage of any diversity factor which may exist between the furnace circuit and the general power circuit and has also improved the over-all power factor of these two circuits to such a point that very definite and tangible savings accrue in the form of reduced bills.

These changes, while including a number of beneficial physical changes in the primary wiring of the plant, could not be justified except on the basis of actual return on the investment. Reports so far indicate that the savings are such as completely to amortize the equipment, including interest and depreciation, in approximately thirteen months.

Similar analysis has resulted in the installation of about 2,000 kva. in capacitor units in the Pittsburgh district in the past eight months in about twenty-six installations. Reports from all of them indicate savings comparable to those enjoyed by the Pittsburgh Equitable Meter Company.

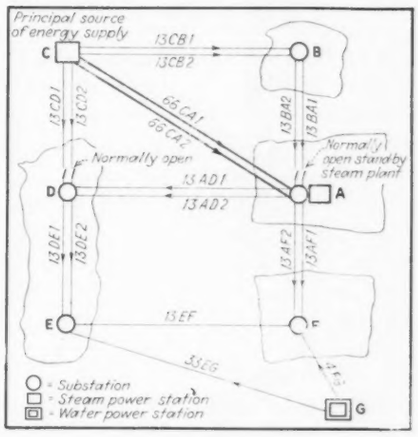
Revised Orders Reduce Outage

Emphasis on Service Restoration Rather Than Resynchronizing in Emergency Orders Benefits Customer Service

IN ELECTRIC systems operating two or more generating stations in parallel system disturbances will sometimes open station interconnections and necessitate the dropping of blocks of load. For the most expeditious restoration of normal service station operators are usually furnished with written orders to be followed in these emergencies. Such orders, if of long standing, may not be applicable as they originally were to system needs and exigencies. In some cases it may be profitable to get out the office copies, ponder over them and ascertain whether or not they still apply.

To illustrate: The accompanying diagram shows the general layout of a system supplying energy to four communities indicated by the irregular areas. Station A is a stand-by and peak-load station only, the greater part of the system energy supply coming from station C on the double circuit 66-kv. line (66 CA 1 and 2). Failure of this line throws the whole system load, except area B, on station A. This station is not regularly operated so that it can assume the entire system load instantly and system frequency and voltage drop rapidly following interruption of the supply from station C. Naturally, then, the first instruction to the station A operator in the emergency operating order is to drop load, and this can be done most quickly by opening lines 13 AD 1 and 2 and 13 AF 1 and 2, completely cutting off service areas D, E and F.

The second instruction of the old operating order was: "When pilot lights show 66-kv. circuits are energized, synchronize and pick up load." The third instruction tells the operator to synchronize with station C on lines 13 BA 1 and 2 and to pick up as much load as the capacity of these lines will allow, in case the 66-kv. supply has not become available when he is ready to synchronize. In the time that was required for acting on these instructions in any particular case service to area DE might have been restored over



Line outages cause less system trouble now

lines 13 CD 1 and/or 2. However, these lines have not capacity for the load in area F also, and neither has the water-power station G. Consequently area F must remain without service until station A is resynchronized with station C.

The effect of these instructions on the station A operator was to impress upon him that, first, it was necessary to restore the connection with station C and, second, to pick up the load that had been dropped. In fact, the urgency of two separate requirements had been twisted about so that the less important received first consideration. From the standpoint of service to customers, the essential thing is to pick up as much load as possible as quickly as possible. The customer does not care when station A is synchronized with station C, but he does care how soon his lamps light and his motors run. Another effect of the frenzied effort to get station A and station C into step again was, sometimes, that breakers would not hold, and by the evidence of lights going up and down all customers were told that the system was in trouble. All of these difficulties were pretty well corrected by rewriting the emergency operating order, putting the more important requirements first.

The first instruction of the new order is to assure clearance of the station A end of the 66-kv. circuits. The second instruction specifies opening breakers on the transformers on lines 13 AF 1 and 2 to area F and on lines 13 AD 1 and 2 to area DE. Opening the breakers on the designated transformers separates the station A generators from the 13.2-kv. system and leaves them carrying the area A load only. Next the breakers on 13 BA 1 and 2 are closed, re-energizing the 13.2-kv. bus at station A. The operator is now instructed to consider the station A generators and the load on them and to use his discretion—in the light of certain detailed suggestions in the order—as to whether he shall try to hold the entire area A load or drop some of it.

Load A taken care of, service is now restored to area F by reclosure of circuits 13 AF 1 and 2. While this has been going on at station A, service to area DE has been restored over lines 13 CD 1 and 2. Up to this point, except for such loads that it may, or may not, have been necessary to drop at station A, the system is entirely energized and the matter of synchronizing has not come into the picture at all. This is taken care of by the sixth and final instruction to the station A operator, who is now told to synchronize his machines, carrying local load only, with the 13-kv. bus energized from station C. Note that the new orders put synchronizing as the last consideration in the emergency switching procedure. If, while the station A operator is carrying out these switching operations, the 66-kv. lines are re-energized, then these lines are put back into service.

The advantages of the orders are:

1. Service can be restored to all substations without waiting for synchronizing.

2. Outside of station A it is not possible for energy to enter any substation from unsynchronized sources.

3. All synchronizing is done at one point—station A.

Hydrogen Gives Sheath Quality

Lead Press With Hydrogen Atmosphere Prevents Oxidation and Promotes Best Crystal Growth in Cable Sheaths

By LYALL ZICKRICK
Research Laboratory,
General Electric Company,
Schenectady, N. Y.

METALLOGRAPHIC investigations have shown the formation of oxides within the sheath during manufacture to be one of the causes of sheath failures. This oxidation is prevented in a new method of manufacture in which hydrogen is employed.

A metallographically prepared ring of lead cable sheath may appear as shown at I, uppermost in the illustration. Suitable etching reveals the fact that the structure consists of a mass of crystals. The size and arrangement of these crystals may vary greatly. Correctly interpreted, they give an indication of the kind of lead used and tell something of the previous history of the sheath, either during manufacture or about the treatment to which it was subjected during service. Lead used in the manufacture of the sheath illustrated at I is a desilverized lead containing a very low percentage of bismuth; lead used in the manufacture of the sheath shown in the other sections contains a small percentage of copper, no bismuth, and has not been desilverized.

The contrast in grain size is characteristic of these two leads, both of which are of good quality. The grain size in cable sheath of a particular lead may also vary with its change in temperature during extrusion; high extrusion temperatures will cause larger grains in the sheath than low extrusion temperatures. The area in the sheath corresponding to that where the charges join in the lead press cylinder also often exhibits different grain size.

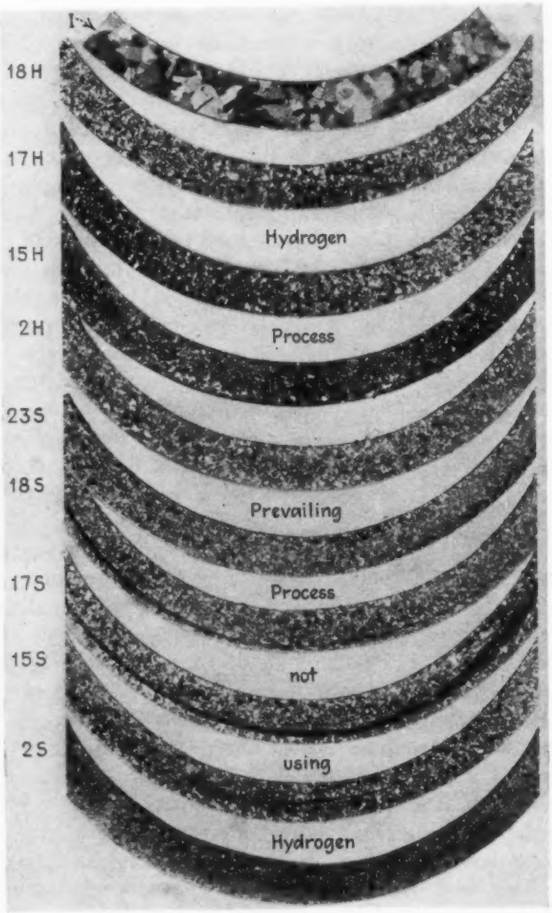
Exclusion of oxygen essential

Lead in the molten state and at a temperature of 750 deg. F. has a great affinity for oxygen and rapidly oxidizes when exposed to air. In conveying molten lead from the melting kettle to the container in the press it is generally exposed to the atmosphere. Moreover, when falling into the container there is considerable splashing, producing finely divided particles of molten lead which are exposed to the air. Such an exposure results in the formation of an enveloping film of oxide around each particle. This more or less oxidized portion tends to segregate to the top and center of the charge, where a part of it may be removed by skimming.

It is uncertain, however, just how much of this oxidized mass has time to collect on the surface before it is necessary to lower the ram, and an appreciable quantity may remain. These oxide films prevent crystal growth and cause the lead particles to remain more or less intact in their original minute size, and may appear in the sheath as an exceedingly fine grained constituent. When extrusion takes place this oxide-containing portion of the charge moves into the sheath along the outer end or extremities of the tongue-like formation and is also more or less distributed throughout the entire flow line area. Its seriousness is one of degree, and if present in appreciable quantity may result in an area of possible future failure.

Because of the oxide films envelop-

Cable sheath improved by extrusion in hydrogen atmosphere



Regular runs (without hydrogen)—All specimens selected at the indicated intervals from press mark in a charge extruded in the usual manner: total length of charge 156 ft. and specimens taken every 6 ft. The flow line or oxide-containing area appears over a length of approximately 36 ft. and is in evidence in six of the specimens, three of which are shown.

2S, 12 ft. No flow lines or sub-oxide area present. 15S, 90 ft. Beginning and first evidence of sub-oxide and flow-line area. 17S, 102 ft. Well developed flow-line area with concentration of sub-oxide areas at the extremities of the tongue-like structure. 18S, 108 ft. Note rapid progress of "tongues" toward each other and movement of flow lines toward exterior of sheath, rapidly losing prominence. 23S, 138 ft. Better quality sheath immediately follows area illustrated in 18S and extends on for the remainder of the extruded charge.

Regular runs (with hydrogen) — All specimens selected at intervals indicated from a charge extruded under the protection of hydrogen to prevent oxidation of the lead. Total length of charge 156 ft.; specimens taken every 6 ft. The flow line or oxide-containing areas which appear in S specimens have been eliminated.

2H, 15H, 17H, 18H, 12 ft., 90 ft., 102 ft. and 108 ft. respectively from press mark. No flow lines or sub-oxide area evident at any section.

I—Normal crystal structure of lead sheath manufactured from a pure grade of desilverized lead containing a very small percentage of bismuth.

Keeping air away from molten lead is one big step in improving cable sheath quality. Air and its oxygen may be (1) eliminated or (2) replaced by a deoxidizing atmosphere—hydrogen in this case. Result is sheath uniformity at all points and better quality too. Cable sheath failures are headed for control and reduction. Service continuity is the gainer by the advances being made.

ing these minute particles cohesion between them is inferior, whereas a clean grain boundary is usually a source of strength. Areas in the sheath showing any great degree of concentration of this oxide material will break upon a small amount of bending; clean-grained cable sheath will endure a great deal of bending.

In 2S, 15S, 17S, 18S and 23S are shown photomicrographs of sheath specimens selected at intervals throughout a 156-ft. length of lead cable, representing the extrusion of a complete charge. Only halves of the photomicrographs are shown, the other halves being more or less "mirror" images of those shown. This sheath was extruded in the usual manner. The flow line, or area containing oxide film, extended over approximately 36 ft. of the 156-ft. length of pipe. Specimens for examination were taken every 6 ft. and photomicrographs of five of the 26 specimens are shown. Specimen 2S is representative of the first fourteen 6-ft. lengths, or 84 ft. of pipe.

Specimen 15S, 90 ft. from the press mark, shows the first indication of this flow-line area. Twelve feet beyond, in specimen 17S, the area has reached its maximum prominence. Here, it may be noted, the greatest concentration of oxide-enveloped constituent is at the extremities of the tongue-like structure, and it is across this particular portion of the sheath cross-section that the poorest resistance to bending will be found. Six feet farther along the pipe the flow line area is losing its prominence and becoming cleaner, as shown in specimen 18S. The extremities of the two tongues are growing closer together and approaching the bottom weld area, which is half way between. This structure practically disappears in the next 6-ft. length, and the remaining portion (42 ft.) of the sheath is identical with the specimen illustrated in 23S.

Hydrogen atmosphere adopted

Early experiments indicated the vital necessity of preventing the formation of oxides when filling the lead container and taking steps to insure the use of clean lead. Various reagents were first tried, and finally hydrogen was used because it both reduces oxides and prevents oxidation.

Hydrogen in contact with molten lead at a temperature of 750 deg. F. reduces lead oxide to pure lead almost instantaneously. Further to aid oxide reduction and prevent any chilling effect, the hydrogen is ignited so that the exterior portion is burned before passing into the atmosphere. This helps to maintain the lead at the desired temperature, speeds the chemical reaction and eliminates any explosion hazard likely to occur because of air-hydrogen mixtures.

A generous flow of hot hydrogen is brought to bear upon the stream of molten lead as it flows to the lead press container. As the lead falls from the end of the spout it passes through a heavy blanket of hydrogen, which applies a thorough cleansing action, reduces any oxides present and protects the lead while molten in the container. The full force of hydrogen is always turned on before the ram is raised, to prevent the entrance of cold air into the chamber to be filled. As an extra precaution, when the cylinder is full, the top of the molten lead is skimmed in the usual manner before the ram is lowered.

Experimental investigations have shown that hydrogen is insoluble in both molten and solid lead.

The beneficial effects of using hydrogen in cable sheath are very pronounced and the use results in practically the total elimination of the oxide areas. Sheath extruded under identical conditions to that illustrated in 2S, 15S, 17S, 18S and 23S, except that hydrogen was used as a protective and reducing atmosphere, is illustrated in 2H, 15H, 17H and 18H. For comparison, specimens taken from similar locations throughout the charge are shown in the illustrations and are found to be free from flow-line areas. Examination of specimens taken every 6 ft. throughout the 156-ft. length of pipe shows a structure similar to those illustrated and no flow-line area was found.

Cable sheath extruded under manufacturing conditions carefully controlled to prevent oxidation of the lead while in the molten state should be of endurable quality and free from weak and inferior areas. The above is an illustration of one of the recent steps taken to improve manufacturing procedure in the production of lead sheath for power cables.

William H. Taylor Says:

President Philadelphia Electric Co.

"Careful analysis of various proposals now before the public respecting the electric industry give me confidence that our company is able to meet any of them on an equal and competitive basis, even at the existing high level of taxation and with present labor and material costs.

"With full use of electric service by our customers, existing rates of our company compare most favorably with experimental rates, actual or proposed . . .

"But our company is not proposing to stop there. We thoroughly believe in the principle, symbolized by Henry Ford, of large quantity production and use at the smallest unit cost and profit.

"Subsidies have no place here."

One of a Series of Intimate Talks With Industry Executives

Allen on Financing Dealers

An Interview by
EARL WHITEHORNE

YOU can't get far away from the subject of appliances these days when you are talking to electrical men. You may start on any topic from the coalpile to the meter, but the all-absorbing issue is domestic load and how to get it. Will people buy enough equipment to produce an adequate revenue on lower rates? Can the minimum bill consumer be sold something to make him profitable? Can present excess capacity be absorbed in domestic service? The market for line equipment, wiring materials, almost everything electrical, waits on the answers to these problems, and everybody is watching to see what will be done.

Arthur Allen, vice-president of the Westinghouse Electric & Manufacturing Company, has just come into the merchandising picture. After a broad experience as a lamp man, he was put in charge of the Westinghouse merchandise lines and went to Mansfield to see what it was all about. So he joins the household appliance industry with a fresh viewpoint. I asked him what he thought was the most important thing to be done for the development of this domestic market.

Not cost but cash

"Take it all in all," he said, "it looks to me as though the key log of this jam is dealer financing. There is a growing desire for appliances today—all the way from refrigerators to toaster stoves. The idea is taking hold, thanks to years of promotion plus the powerful publicity of the present government program. Also, rates are coming down so that the cost of using them is not a barrier. It's putting up the money that hurts. There is the hardest thing to overcome in the whole load-building job.

"The cost of appliances today is not excessive. People who buy Ford cars and Chevrolets and Plymouths want good quality in refrigerators, ranges and ironing machines. Flooding the market with cheap, unsatisfactory equipment would not increase residence consumption much. The real need is to make it easy for women to acquire those appliances that they want. And that means small payments over a long term.

Need for dealers

"Department stores are the most experienced merchants in the country. They know how to sell to the home and they make every dollar count. So when they sell this equipment over two and three years' time at a straight 6 per cent interest, electrical men might just as well look the situation in the face. The dealer, of course, can't finance himself on any such basis. He can't compete with the big stores. Yet it is vital to the industry that the largest possible number of dealers engage in this business, to provide convenient neighborhood distribution and hasten the day when these appliances will all be standard equipment in the home.

"The simplest and most logical answer that I can see is for the power company to finance dealer sales to its consumers and collect the money. Enough utilities are already doing it to prove that it is practicable and show the losses to be very small. They are negligible compared with revenue gained. And I see no reason why this is not a proper function for the power company, since the collection department is just as much a public utility as the stations and lines. There is no reason, therefore, why these facilities should not be used in the public interest, to help people acquire the benefits of electricity in their households by making it easy for them to buy.

"The department store will sell a steadily increasing volume of these appliances. But that only affects the larger communities. After all, the small town is America, and a great part of this selling must be done by the small dealers in the rural country and in the neighborhood stores in town. But if the industry is to have this man-power at work building this load the utility will have to make it possible for its customers to buy from them on the easy terms that get action."

Allen is optimistic. He thinks the market is riper than the industry appreciates. He sees a great forward movement in home electrification, just waiting for a few traditions to get out of the way and a little lubrication to be applied. We have played with financing a long while. Now we must use it, he thinks, as a universal appeal. The trial-rental idea is moving ranges. It's just more proof of the sales power that lies in making it easy to buy. He feels that the utilities should all lay aside their natural reluctance to finance dealers and get this load piling up.

A new attitude

"People are coming out of the hard times with a new attitude toward getting what they can out of life," Allen says. "If the industry will take this step, we can make it simpler for these families to gratify their growing desire for the comforts of electricity. There is nothing else that will stimulate the sale of appliances so quickly. For no matter how complete a job a utility is doing, it needs the combined effort of every possible selling agency. Helping the dealer, particularly with his financing, is one of the cheapest things the power company can do to help build load."

Certainly there seems to be a lot more promise in such direct action than in just trying to sell harder in the same old way or waiting for a miracle. And why not, since the buyer willingly pays the interest on the money?

ARTHUR ELLIOTT ALLEN, vice-president of the Westinghouse Electric & Manufacturing Company, a veteran of the lamp industry, now heads the company's appliance division and, with a fresh viewpoint on merchandising problems, discusses the present job of building domestic load.

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Washington Plan Comes Into Broadened Favor

ANNOUNCEMENT of the offer of the New York City utilities gives a great boost to the so-called Washington plan. That plan is essentially a scheme whereby rates are automatically accorded a reduction as soon as it is established that the rate of return upon a progressive rate base exceeds a stipulated amount. Conversely, if the rates fail to produce the requisite revenue after a reasonable period they will be correspondingly increased. In the consent decree now governing the Washington situation a sliding scale was established that made the share of excess earnings allocated to the customers through ensuing rate reduction an increasing one as those earnings rose above 7 per cent.

By such simple formula the plan seems to accomplish what rate regulation has been set up to accomplish—give the customers as low a rate as possible and still do justice to the investor. It provides in advance for annual adjustment. In Washington it has worked smoothly and successfully. The average residential customer used 937 kilowatt-hours during 1934 and paid $32.43 for them, an average price of 3.46 cents. Meanwhile the rest of the country used 629 at an average cost of 5.29 cents. Washington residents thus consume 49 per cent more electricity and pay 35 per cent less for each unit. Actually they spend for their service only 80 cents less per month than the average American.

It should be remembered that it has taken more than eight years to attain this result which carried the top rate from 7 down to 3.9 cents. Another thing is that the plan depends absolutely upon a long range commitment of the state and its commission to respect the agreement, subject, however, to minor modification of details from time to time. When rates prove insufficient, it does accomplish then, largely as a matter of automatic routine, what has otherwise tended toward prolonged litigation. Its greatest virtue is probably that it makes the public a direct participant in the company's fortunes. The consumer tends to lose his feeling of isolated exploitation.

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Over Half Industrial Capacity Needs Replacing

AT LEAST 53 per cent of all manufacturers' generating-plant capacity is more than ten years old and considerable more than twenty years. Probably the percentage is higher, because this figure is based on *Power's* analysis of 454 progressive plants in fourteen major industries, having 10 per cent of the total industrial generating capacity, and is not swelled by the higher obsolescence that must exist in the less progressive plants. Since the prime movers committee of N.E.L.A. once reported that steam-generating equipment and prime movers have been found, by experience, to become obsolete in as short a time as seven years, at least 53 per cent of industrial generating capacity must therefore be obsolete.

Therefore if industrialists expect to reduce their production expenses they had better replace this obsolete equipment. One way is with purchased power. By so doing they will not have to invest money that can better be diverted to modernization of manufacturing processes and selling their products. Then they will not have to worry with fixed and operating charges on generating equipment when business is poor, nor bother themselves with adding power facilities when business improves.

In none of these industries is the percentage of obsolete equipment lower than 20 per cent. In all except four groups—(1) rubber, (2) petroleum and coal products, (3) stone, clay and glass, and (4) chemical—the obsolescence ranges from 41 to 69 per cent. So all other industries should study carefully opportunities for savings.

While 81 per cent of all these plants use process steam to some extent and some have waste heat or waste fuel, only a careful analysis of the concurrent availabilities of waste heat and demands for power and process steam can show how much power it is economical to generate. Experience indicates that great economies can be effected by purchasing a large percentage of the power used or interchanging energy with utilities. The rubber, non-ferrous metal, machinery, and petroleum and coal-products manufacturers, reporting, already purchase up to 1.5 times as much power as they generate. Why do the others, who have less favorable conditions for generation than the petroleum and coal-products manufacturers, use a smaller percentage of purchased power?

Definite intentions of remodeling their power plants within the next two years are reported by 29 per cent of the 454 industrials included in this survey.

While the reports must be considered in the light of age of existing equipment, only four groups—textile, food, rubber and iron and steel—show a high disposition to modernize their plants, 18 to 21 per cent intending to do so within one year.

Of the manufacturers reporting, 21 per cent will revise their steam-generating equipment and 18 per cent will change their power-generating apparatus within two years.

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Trolley Coaches as a Load

SOME 460 trolley coaches are now in service in 24 American cities and during the coming year they will use about 56,000,000 kw.-hr. of electric power. About 400 are 40-passenger vehicles, each taking about 28 kw. normal load from the central stations supplying power to the transportation properties. In winter months, in the Northern cities, the average load per coach will be increased by some 9 kw. for heat, so the 400 vehicles require about 15,000 kw. of station capacity. On an average, each of these coaches will operate about 4,200 hours per year and consume about 125,000 kw.-hr. of electric energy.

In addition to this, about 60 more 30-passenger trolley buses are also in service, each having an average consumption of about 22 kw. and an average demand in winter of nearly 30 kw. Operating 4,200 hours, or 50,000 miles per year, each will use about 100,000 kw.-hr. of energy, and the 60 should consume around 6,000,000 kw.-hr. per year and require about 1,800 kw. of station capacity.

Figured as the equivalent of so many domestic customers or so many commercial lighting or power installations, this represents a volume of business worth carrying. It is worth keeping also. There is a sales job to be done, therefore, in every city where the power company sells the transportation property and faces the possibility of the eventual transition from street cars to buses.

It is obviously desirable to retain as much as possible of this load for which facilities have already been provided, particularly if the power company owns and operates the substations and sells d.c. energy. And where central stations sell to a transportation subsidiary at special low rates, the retention of a part of the load, through the use of trolley coaches, will stabilize output and carry at least a part of the overhead. It will continue on the books, as used and useful property, the value of the investment in transmission and distribution lines and substations that would have to be abandoned if gas buses take the place of street cars.

Much good load has been allowed to slip off the lines in the past ten years as street car lines have been abandoned. To save the rest power company sales departments may well study this trackless trolley load and sell it.

Competition in Power Sales

WHILE every one is admiring the spectacular increase of electricity use in the home, it is not remarkable that utility managements have allowed thinking and planning for the domestic load to crowd other markets into the background. But the power salesman is beginning to feel that the new baby is getting too much attention and the older children too little. He does not like it because it offends his pride. He resents it because he is on the spot. Industry today must shave every corner to earn sufficient return merely to keep itself going. In this condition power costs are being scrutinized as never before. And if electricity is being bought from a central station any bill is apt to look too high and competitive power sources are apt to receive closer and more sympathetic consideration. And to make matters worse from the standpoint of the power salesman, these competitive power sources have had a remarkably accelerated development in the past few years.

Isolated plant competition that rests upon truthful statements of performance and on real improvements in small unit power plant equipments made in the past few years is nothing to scare a competent power salesman. It is the competition that wrings every possible advantage from a politically inflamed popular feeling that the power salesman does not like. And he is getting a lot of that kind of competition.

The power salesman is in the position of knowing exactly what must be done. But he has no authority to do it and is frequently unable to get adequate interest from his management. Too often he is told that it is his job to sell power at the published rates and a deaf ear is turned to his arguments that rates and forms of rates must change, that special cases demand special treatments and that today the central station must *sell* its product to industrials, not simply offer to *supply* their demands.

The power salesman is up against three competitions. One is the lack of interest and sympathy in his problems which is exhibited by his own executives because of their absorption in domestic load building. This competition is wholly indefensible and could be corrected overnight by a change in executive attitude. The second is the "Too high, too high" hysteria over electricity bills. The third competition is the only honest one. It is progress. It is the same progress represented in engineering decisions to put the power plant close to the load, the progress that a few years back checked the spread of transmission systems.

Are industrial power sales rising more slowly than industry itself? Could more power be sold to industry than is being sold? We don't know the answers to these questions, though they are important. But what we do know is that the power salesman is meeting a stronger and a more dangerous competition than ever before and he needs continuous and sympathetic cooperation from his own executives.

Holding Groups Hit by Trade Commission

Greed held motive in electric light and power expansion — Attacks prices paid for stocks in competitive bidding — Associated Gas protests charges

Desire for commercial expansion, greed and personal ambition to become dominating factors in the industry unquestionably were major motives in the development of large combinations of electric power utilities, the Federal Trade Commission told the Senate last week in another chapter of its report on its investigation of the electric and gas companies.

The financial motive for such expansion was early in evidence, the report stated. The large amount of money required for the enormous development that took place called forth great activity in getting capital interested, the commission said. "Securities to fit the ideas of all classes of investors were produced and marketed. Mortgage bonds on the plants and other fixed investments of operating companies were issued for the more conservative investors, while the common stocks of holding companies which held the common stocks of operating companies were offered to the speculative buyers. Later, even the common stocks of an apex company of a series of super-holding companies, pyramided one above the other—'the equities of equities'—were able to find a wide demand."

Discussing the importance of large holding company groups, the report maintains that extension of such control continued until in 1929 to 1932 sixteen large groups controlled more than three-fourths of the privately owned industry.

Competition and combinations

In another subsequent installment the commission stated that competition among the holding companies to gain control of operating properties in the public utility field became so keen during the 1922-1932 decade that, in an extreme case, the successful bidder paid $531.04 per share for the stock of a company which accountants of the commission computed to have a book value of $2.97 per share. The report definitely named Associated Gas & Electric Company as guilty of this extravagance.

Discussing the relation of investment bankers to holding companies, the commission observes that no large holding company structure now existing has grown to its present size without the aid of investment bankers. The resulting situation, says the commission, is one in which there is great pressure on holding company managements to give a great deal of attention to the desires and alignments of investment bankers in the formation and operation of holding company groups.

Taking exception to the comments made by the commission, Associated Gas & Electric Company charged that body with a serious distortion of the facts. "Its conclusions," the statement said, "are based entirely on considerations which have no bearing upon the question of whether the acquisition was in the public interest. Facts outlined in its original report recognize the soundness of this acquisition, but now are scrupulously ignored, apparently for the purpose of sensationalism."

$20,000,000 Fund Asked for Fort Peck Dam

In his annual report to the Secretary of War, Major-General Edward M. Markham, chief of army engineers, recommended a $155,000,000 fund to continue construction of river, harbor and flood-control projects through the fiscal year July 1, 1935, to June 30, 1936. Among the large projects was the Fort Peck Dam, for which $20,000,000 was asked. Major-General Markham estimated that the work of constructing the great Fort Peck dam and reservoir would be far advanced by June 30, 1935, and that expenditure of an additional $20,000,000 during the following year would see all major operations practically completed, including the construction of the town site, construction of railroads, bridges and power lines and excavation of the four huge tunnels.

Consolidated Rate Cuts Rejected by Federal and City Governments

Carlisle insists on Washington plan — His proposal to cut federal bills $60,000 spurned — La Guardia turns down his offer to arbitrate on city's electricity costs — Application filed for P.W.A. loan

Proposal by the Consolidated Gas System to cut by $60,000 a year the bills of the government for lighting in federal buildings and power for other federal purposes in New York was rejected this week by the federal government through Rear-Admiral R. E. Bakenhus, Public Works officer in the New York district. In Washington Secretary of the Treasury Morgenthau stated that the government had no intention of abandoning its plans for its own power plant in New York even if the companies reduced their rates. The companies had had their chance to reduce rates, the Secretary indicated.

In his offer addressed to Rear-Admiral Bakenhus, Floyd L. Carlisle, chairman of the board of the Consolidated Gas Company, said: "We earnestly desire to continue our sales of electric current to the federal government and to other government purchasers. The loss of this business to us would mean a very substantial reduction in our earnings and reduce very considerably the amount of rate reductions that could be made to the general public . . . We are prepared to reduce by $60,000 per year our present charges based upon the consumption for the year ended June 30, 1934, and the application of this amount may be made in such a manner as will distribute it most equitably between the various points of service. We are prepared to discuss in detail this matter and to discuss the rates that would follow the purchase of additional current by reason of the new buildings under erection."

Rear-Admiral Bakenhus replied in part: "In view of the amount of the prospective annual saving to the federal government that will result from the construction of a federally owned and operated power plant, I find after some consideration and conference that I do not see my way clear in the present situation to recommend acceptance of the proposal which you made . . ."

Application for loan filed

Application for a Public Works Administration loan of $3,780,000 to build a federal power plant to supply electricity to twelve large federal buildings in New York City has already been approved by Secretary Morgenthau, on recommendation of the Treasury's Pro-

curement Division, and has been forwarded to Secretary Ickes.

La Guardia asks 20 per cent cut

In the meantime negotiations between the New York City administration, the state Public Service Commission, the legislative utility investigating committee and the Consolidated Gas System continue. This week Mayor La Guardia, in a letter to Mr. Carlisle, asked the companies to put into effect immediately a 20 per cent cut in their light rate charges to general consumers as a sign of the good intention of the companies. He asked that the cut be put into effect pending adoption of the Washington plan of rate reduction or any similar plan. The Mayor's letter was in reply to a letter written to him by Mr. Carlisle, in which the utility executive asked that the dispute on the city's own bills for power for municipal purposes be turned over to an arbitration board.

Rejecting the Mayor's demand for a 20 per cent rate cut, Mr. Carlisle said: "This would mean a slash of about $32,000,000 in our revenues and, with increased taxes and operating costs, would leave the company with only $4,000,000 of income for payment of preferred-stock dividends requiring $10,500,000, after omitting all dividends on the common stock. Officers of the Consolidated Gas Company must maintain the financial stability of this great enterprise. . . . For 1935, the present taxes, if enforced against us, will amount to about 22 per cent of our gross revenues. In Washington, where lower rates have been realized, taxes are stated to be about 11¼ per cent of gross revenues. This difference in taxes alone would amount, as to our companies, to about $26,000,000, which is a large part of the $32,000,000 you ask for as a rate reduction . . ."

Previous to this interchange of correspondence between Mr. Carlisle and Mayor La Guardia, Mr. Carlisle said at a conference with John E. Mack, counsel for the legislative utility investigating committee, that the Consolidated system would be willing to make substantial "write-offs" in its valuation estimates, consolidate all the seven electric operating companies into one and establish uniform rates in New York City and Westchester, under the Washington plan of rate reduction. The following day Mr. Carlisle discussed the Washington plan before the state Public Service Commission. "It is probably," Mr. Carlisle said, "the combination of events, the circumstances of the depression and its long duration, the uncertainties of the future that have led us to depart from what we believed was a proper principle."

A disagreement developed on how the Washington plan should be adopted in New York, if adopted at all. Mr. Carlisle and Mr. Mack favor the plan because of its automatic readjustment features. Milo R. Maltbie, chairman of the Public Service Commission, indicated that if the plan were put into effect it should be for a period of possibly three years, so that any difficulties that developed could be adjusted at the end of the period. Further conferences are to be held.

After the first public hearing on the increased rates asked by the Consolidated companies to meet the new utility taxes the commission, on the request of Mr. Carlisle, agreed to postpone the hearings for two weeks.

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Governor Kump Seeks Justice for Utilities

Delivering his biennial address to the West Virginia state Legislature, in joint session at Charleston, Governor H. G. Kump sounded a warning against legislation which would be inimical to industry and reviewed the importance of the public utilities to the financial life of the state.

"I am well aware of the abuses of large enterprise," the Governor said, "and I am thoroughly conversant with iniquities that unrestrained competition, or unregulated monopoly, may bring on an unprotected citizenry. But I am also aware that our state has turned to her great economic groups for more than one-half of state aid with which to operate her free schools; that we depend upon the public service corporations alone for some 38 per cent of our local and state taxes, and, in my judgment, our economic future depends upon creating an industrial environment in which enterprise—particularly the wage-paying industries—will seek location, secure from arbitrary, unequal and discriminatory treatment. . . . It is fundamental to our ideas of social justice that the consumer of a utility service should have the unrestrained opportunity to make complaint against the practices of a corporation which he considers detrimental to his interest. It is equally fundamental that no citizen, either individual or corporation, shall be required to render a service vested with public interest, for a price he is willing to accept, without an adequate opportunity being given to determine the reasonableness of the rate. . . ."

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Coeur d'Alene Appeal Filed in San Francisco

An appeal was forwarded last week to the Court of Appeals at San Francisco by W. B. McFarland, Cœur d'Alene, Idaho, city attorney, and his associates in the suit of the Washington Water Power Company against the city, in which an order was issued by Federal Judge C. C. Cavanah recently restraining the city from proceeding to secure funds from the P.W.A. to construct a municipal electric and power system (ELECTRICAL WORLD, January 5, page 74). It is believed that the hearing of the appeal will be expedited at San Francisco.

X-RAY TUBE FOR DEEP THERAPY

A shock-proof 250,000-volt tube for deep therapy shows the rapid advances made in electrical developments in this field

Government Leaders Pay Tribute to Engineering Profession

Government officials participate actively in meeting of American Engineering Council at Washington — Support of housing program asked — Council now Washington embassy for engineers, Secretary Feiker asserts — Survey of engineers under way by Labor Bureau

"It is time to uncover new ideas that will pique the appetites of the consuming public." With this is needed leadership to rejuvenate the normal forces of industry and salesmanship to clinch the idea that engineering is what made the nation great and will do it again. That was the message of Col. Don H. Sawyer, director of the Federal Employment Stabilization Office, to the American Engineering Council's meeting in Washington, January 10-12. It typified the tone of Administration speakers from six of the "alphabetical agencies" and five of the permanent bureaus, including the Federal Reserve Board, Department of Commerce and Department of Agriculture.

C. C. Anthony of the Federal Housing Administration asserted that the man who has services and goods to sell is not doing his job in supporting the housing program. Engineers and architects alike are still obsessed with the major opportunities and overlooking the great potential volume of small renovating jobs.

Industry went too far in inviting federal aid, said W. P. Witherow, vice-chairman of NRA industrial advisory board, and added that the Administration is intent upon preventing code and production restrictions which would tend to cause freezing of heavy durable goods industries or, in fact, any component of the economic system. From R. E. W. Harrison, chief Bureau of Foreign and Domestic Commerce, came the assertion that the 200 restrictive clauses in codes resulted primarily because of lack of factual information about the respective industries. He added the suggestion that engineers should do something to encourage greater rewards for inventive ability.

American Engineering Council has become the Washington embassy for engineers and engineering, reported F. M. Feiker, executive secretary. During the year several thousand engineers who were let out of relief work by C.W.A. were taken over by F.E.R.A. or otherwise as a result of A.E.C. negotiations with Administration agencies. This most direct service was accompanied by an intensification of the past activities which have delivered engineering talent and organization to public service. Congressional committees and government bureaus habitually look to A.E.C. as a fount of technical advice and interpretation.

During the coming months a major function is to be the making of a survey of engineers in collaboration with the Bureau of Labor Statistics. Dr. Isidor Lubin, director of the latter, pointed out that the engineering profession is to be the first non-wage group to be accorded such recognition. Questionnaires in excess of 100,000 will shortly be sent out to all engineers on the rolls of the engineering societies (national and local), technical graduates, state registration lists, etc., to bring out their economic status, qualifications, employment experience, industry and occupational classifications. Special emphasis will be put on the mechanism of job-getting so that the most effective means used can be ascertained and developed for future service to the engineering profession.

In the business sessions of the council and assembly action was taken to make the representation more democratic. The cost to local and regional groups will be cut materially. Committees on public affairs will be sponsored in each state rather than state councils patterned after the national organization. These will afford means of disseminating engineering reaction to public responsibilities and opportunities of the engineer. In connection with the council sessions there was a conference of secretaries of national and local societies, 34 being present from all parts of the country, discussing effective administration technique of their bodies in co-operation with A.E.C.

Officers for the ensuing year are: President, J. F. Coleman; vice-presidents, A. J. Hammond, Paul Doty, W. H. Woodbury, C. O. Bickelhaupt; treasurer, C. E. Stephens; executive secretary, F. M. Feiker; chairman of finance committee, William McClellan. The four last are electrical engineers.

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Parker Dam Row Carried to Supreme Court

On request of Harold L. Ickes, Public Works Administrator, Solicitor General J. Crawford Biggs has appealed to the United States Supreme Court for permission to file suit against the State of Arizona, enjoining it from hampering the building of the Parker Dam in the Colorado River.

The court permitted the government to file its complaint and gave the state until April 1 to reply.

PROBLEMS IN HIGHER MATHEMATICS FACILITATED

Wide World

The differential analyzer, popularly known as the "mechanical brain," will soon be completed at the Moore School of Electrical Engineering, University of Pennsylvania. The machine, which weighs 6 tons, will complete in fifteen minutes calculations that would require four months' work by five mathematical technicians

N.E.M.A. Reports on Price Fixing

In survey of prices filed under electrical manufacturing industry code the association reveals results of the operation of open price clauses — "Waiting" period a protection to all companies

Making public the results of an accurate and complete survey of all prices filed under the electrical manufacturing industry code of fair competition between the effective date of the code and November 1, 1934, Frank C. Jones, president of the National Electrical Manufacturers Association, said:

"The operation of open price clauses which appear in many codes of fair competition has brought into the open the actual price situation in many sections of the electrical manufacturing industry in which secrecy, suspicion and fear formerly prevailed.

"The ten-day 'waiting' period provided in the electrical manufacturing industry code, and in many other codes, provides time for the distribution of the new filed prices, so that all members of the product classification subject to a call for filing of prices under the code may be informed of the new prices before they go into effect.

"This practice protects all companies, and especially small companies, from the effects of price changes for which there otherwise might be no warning, and which, because there is no warning, might give the company making a change without warning a temporary and minor advantage, to the disadvantage of all other members of the industry.

"The idea that the 'waiting' period provided for in such open price clauses of many codes of fair competition is an intimidation period is pure fiction, so far as the electrical manufacturing industry is concerned."

Also in connection with release of the results in the study of all prices filed under electrical manufacturing industry code, Mr. Jones stressed these facts:

1. More than 600,000 individual sets of price schedules originally filed or refiled have been distributed to members of the electrical manufacturing industry.
2. 141 calls for the filing of prices for specified products of the electrical manufacturing industry have been issued by supervisory agencies under the code.
3. Approximately 14,500 price filings and refilings took place between August 15, 1933, and November 1, 1934.
4. Of these 14,500 filings, only 87 represented changes filed by the same company on the same product within the ten-day "waiting" period.
5. Of these 87 changes, 65 represented reductions in list prices or less favorable terms.
6. Of the 22 cases involving increases of list prices or less favorable terms—(a) two cases resulted in net prices exactly the same as the previously filed net prices; (b) three changes were to correct obvious errors; (c) thirteen were small changes of only one item in a catalog of from 30 to 75,000 items; (d) nine changes involved only changes in terms or shipping allowances; (e) eight were small increases of list prices or small decreases of discounts; (f) in one case of the above eight, the manufacturer increased the list on two items but decreased on eight, with 28 being unchanged. The two increases were small, compared with the eight decreases.
7. The upward changes, other than obvious errors or combination changes that resulted in the same net prices, were evidently made individually by members of the industry after they had opportunity to see the filed list prices and terms of other members of the industry and had opportunity to discover that current prices were not as low or as high as rumor and fear, in an atmosphere of secrecy, had led the individual manufacturer to suppose.

The records of the Electrical Manufacturing Industry Code Authority, which the N.E.M.A. staff surveyed, show the date on which every price filing made by every company was received, the date on which it became effective and the date on which it was mailed to competitors.

A search was made of every price filing made by any one company within ten days from the date of a previous filing by it. All such changes were traced back to the original price schedules themselves to determine exactly what changes had been made.

There were discovered, of course, many instances of companies filing new price lists within ten days of the date of a previous filing. In the great majority of these instances, however, the products involved in the two filings were not the same and the case therefore had no significance.

In case it was determined that the same identical product was involved, the next step of the members of the N.E.M.A. staff was to determine whether the change involved was an increase in the list price or a decrease in the list price, or a change to less or more favorable terms.

COMING MEETINGS

American Institute of Electrical Engineers—Winter convention, New York, N. Y., January 22-25. H. H. Henline, National Secretary, 29 West 39th Street, New York, N. Y.

National Electrical Manufacturers Association—Midwinter conference, Waldorf-Astoria Hotel, New York City, February 6-8. W. J. Donald, 155 East 44th Street, New York.

National Fire Protection Association—Electrical Committee, biennial meeting, Electrical Association of New York rooms, 46th Street and Lexington Avenue, New York, March 19-22. V. H. Tousley, secretary, Electrical Committee, 612 North Michigan Avenue, Chicago, Ill.

Electrochemical Society, Inc.—Spring meeting, New Orleans, La., March 21-23. Dr. Colin G. Fink, secretary, Columbia University, New York.

EVENTS IN WASHINGTON

A partial report by the Federal Power Commission on the rate survey will shortly be submitted to Congress. This particular report will cover, as of January 1, rates in cities of 50,000 and over. All rates have been reduced to a comparable basis. Rate reductions since July 1, 1934, will be shown.

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Action of the Supreme Court of the United States in granting the government permission to file an original suit against the State of West Virginia greatly expedites the settlement of the fundamental issues involved in the Hawks Nest project on New River. The suit goes to the heart of the authority of the federal government over both navigable and non-navigable streams.

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Amendments to the water-power act which will provide for federal regulation of interstate movements of power are still under study by the Federal Power Commission. The proposed control, it is stated, will be in co-operation with state public service commissions.

PAUL WOOTON,
Washington Correspondent.

Hawks Nest Project Taken to Supreme Court

The Department of Justice has abandoned its action in the United States District Court at Charleston, W. Va., to compel the Electro-Metallurgical Company, the New Kanawha Power Company and the Union Carbide & Carbon Corporation to obtain a federal license to develop the Hawks Nest hydro-electric project on the New River and simultaneously started a new action in the United States Supreme Court in an effort to get the case before the highest tribunal as soon as possible.

The State of West Virginia, which entered the case as an intervener in opposition to the government (ELECTRICAL WORLD, December 8, page 42, was named as a defendant in the new action. The high tribunal gave the state and the three private companies until April 1 to reply to the complaint of the United States. At the same time the state was directed to show why a suit of like nature should not be filed to test the right of the government to push two projects of its own on the Kanawha River. West Virginia has set up the plea of state's rights.

Power Bonds Safe, Roosevelt Maintains

President makes public report prepared by Federal Power Commission — Savings banks and insurance companies hold small investments — Appreciation of bond values, report claims

Bonds of electric utility operating companies received the Administration's indorsement last week as President Roosevelt launched his program for the drastic control and regulation of holding companies. Ready to send his legislation to Congress, the President made public at a press conference a report prepared at his order by Basil Manly, vice-chairman of the Federal Power Commission, which constitutes his reply to critics of the power program who have stated that furtherance of it would injure life insurance companies and savings banks and thereby harm the "widows and orphans."

The report stated first that these institutions have invested almost exclusively in the bonds of operating companies. They hold few preferred stocks and practically no common stocks. They have almost no holding company securities of any kind. The report finds, secondly, that the total utility holdings of life insurance companies range around only 9 per cent of their total assets, while the savings banks of New York, taken as an example of the bank situation, have less than 3 per cent of their assets in utility investments.

Comparison made in market values

Comparison is first presented in the report of the current price of public utility bonds of the class held by life insurance companies and savings banks with the prices prevailing at the height of the stock market boom of 1929. This shows that the average market price of such bonds is now 6.6 points higher than in September, 1929. "Applying this average appreciation of 6.6 points in the actual bid price of a large list of representative bonds to the total public utility bond holdings of the 51 standard life insurance companies ($1,658,209,000 in December, 1933), we find that their market value is now $109,441,000 higher than it would have been in September, 1929, before the stock market crash of that year," the report continues.

Rayburn of Texas lists abuses

Meanwhile, Representative Sam Rayburn of Texas, chairman of the House committee on interstate commerce, in an address in the House, attacked the holding companies as "soulless creatures," wielding enormous power for evil, paying "astonishing" salaries and bonuses and serving no economic or otherwise useful purpose. He listed fourteen abuses of holding companies, which included fostering of fictitious stock subscriptions, inflation of income, arbitrary apportionment of expenses to operating companies in excess of their actual figure, abuses in the appraisal of properties by service companies and exorbitant salaries and bonuses to company officials.

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Federal Rule Urged for Holding Units

In its annual report Federal Power Commission says regulation is a necessity — Urges legislation to widen control

Federal regulation and control of electric utility holding companies was termed a "necessity" in the fourteenth annual report of the Federal Power Commission made public last week. "Such regulation and control," the report stated, "is not only a necessity for the protection of consumers and investors in operating utility companies, but likewise for the protection of the public rights which the federal water-power act seeks to preserve in the water resources of the nation."

"Holding companies," the report points out, "present a serious obstacle to the prompt and orderly determination of capital investment in licensed projects, since most licensees are controlled by holding companies which manage and supervise their affairs, including construction, engineering and financing. Under existing legislation the commission has no direct supervision over these holding companies, nor has it the authority to compel them to produce their books and records. As a result, in many cases the facts necessary to determine the actual legitimate cost of projects are either buried in accounts outside the commission's jurisdiction or are claimed to be no longer existent."

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Bare Neutral Wiring Given Setback in Electrical Code

On going to press, notice is received from A. R. Small, chairman electrical committee, N.F.P.A., that the report of the special committee on bare neutral interior wiring systems has recommended that the 1935 edition of the National Electrical Code do not give further recognition to bare neutral wiring. Inspection authorities should, however, have no hesitancy in permitting trial a.c. installations under conditions limited to metal-clad systems of wiring. Plumbing, water works and sanitary associations had opposed the practice by resolutions. H. R. Searing, in filing a minority report, cited New York Edison experiments refuting the claims of water service companies.

$40,000,000 Fund Asked for T.V.A.

President Roosevelt in budget message requests furtherance of program — Alabama cities restrained from obtaining federal loans — U.G.I. head challenges right of government to compete

Congress was asked for $40,000,000 by President Roosevelt in his budget message to carry on his economic and social experiment in the Tennessee Valley during the fiscal year ending June 30, 1936. The President showed that the authority had already received $75,000,000, of which only $27,526,354 had been expended to October 31, 1934. The valley program, covering the "yardstick" power operations, fertilizer experimentation, dam building and general economic and social planning, was put down as needing the $40,000,000 in addition to the $47,473,645 still unused in October.

Federal Judge W. I. Grubb issued an order in Birmingham last week temporarily restraining the fourteen north Alabama municipalities involved in the Tennessee Valley Authority's power program from borrowing money from the P.W.A. for construction of their power distribution plants. This order came shortly after Mayors of three of the towns—Sheffield, Florence and Tuscumbia—had announced receipt of signed contracts for loans totaling nearly $800,000. The stockholders' suit for an injunction to prevent the sale of the power properties to the T.V.A. is awaiting trial before Judge Grubb.

Project still under attack

The right of the government to compete against private enterprise in the production and sale of electric light and power was challenged last week by John E. Zimmermann, president of the United Gas Improvement Company. Mr. Zimmermann, who spoke before the Wharton School, University of Pennsylvania, assailed the Tennessee Valley Authority, which he described as "the latest and most dangerous threat to the theory upon which our government was established."

Charging that the present government development of hydro-electric plants under the guise of soil erosion and flood control is an extravagant delusion and the T.V.A. yardstick a deception and a fraud upon the consumer, the taxpayer and the holder of utility securities, Dr. Hugh S. Magill, president of the American Federation of Utility Investors, recently declared that if the national orgy of spending continues the American taxpayer will wake up to find himself the victim of burdensome taxation that will stifle the business enterprises of the nation for the next 50 years.

Muir Suggests Plan to Aid Capital Goods Industries

In a statement made last week Malcolm Muir, president of the McGraw-Hill Publishing Company and a member of the National Industrial Advisory Board, expressed the opinion that the process of recovery has now reached the point at which much further progress is not likely without an improvement of production in the capital goods industries. Mr. Muir suggested two measures to revive the durable goods field. One was the granting to business men of an income tax credit on purchases of new plant machinery and equipment. Another was modification of the securities act as soon as such can be made in the light of experience in the application of the act.

"I feel that this year will show a moderate improvement throughout the whole field of business and industry," Mr. Muir said, "with the rate of improvement depending upon the degree to which the Administration will put into practice, through the legislation that is coming out of Congress in the next few months, the principles enunciated by the President of stimulating private enterprise, and also upon the degree to which business men will continue their own co-operative efforts in the direction of business revival and the amount of enterprise and initiative they display in promoting their own businesses throughout this period."

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Survey Finds Output Rising

Reported by the U. S. Geological Survey as 7,602,000,000 kw.-hr., the amount of energy generated in public utility plants during November exceeded that of the like month in 1933 by 5 per cent. This is the same rate of gain as in October, when the output amounted to 7,828,000,000 kw.-hr. Water power contributed 2,937,000,000 kw.-hr., or 39 per cent of the total, against 34 per cent in October.

Average daily production was greater than in any preceding month of 1934 and greater than in any month of 1933. It amounted to 253,400,000 kw.-hr., an increase of 1 per cent over October. This is about the normal increase at that season. Average daily production from water power was 13 per cent larger than in October and 17 per cent larger than in November a year ago. Average daily output from fuel fell off 6 per cent from October and was 1 per cent less than a year ago.

The quantities are based on the operation of all power plants producing 10,000 kw.-hr. or more per month, engaged in generating electricity for public use, including central stations, both commercial and municipal, plants for electric traction and others contributing to the public supply. The percentage gains over 1933 were greatest in the West North and East South Central states, as is shown in the following table:

Division	Per Cent Over 1933 — Sept.	Oct.	Nov.
New England	— 9	—2	+ 2
Middle Atlantic	+ 1	+5	+ 2
East No. Central	+ 1	+6	+ 4
West No. Central	— 1	+5	+12
South Atlantic	—14	+5	+ 7
East So. Central	—10	+9	+18
West So. Central	+ 1	+4	+ 7
Mountain	—13	+1	+ 6
Pacific	+ 6	+6	+ 4
United States	— 2	+5	+ 5

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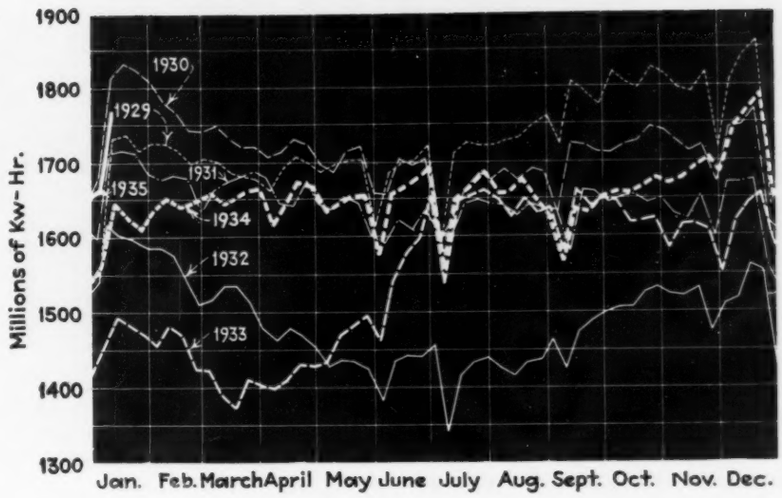
Federal Loan for Cleveland

Cleveland, Ohio, City Council voted last week to request a $3,000,000 federal loan to expand the municipal light plant. A three-million-dollar loan would finance all the light plant expansion that engineers believe will be necessary for years, providing cash not only for new power-generating equipment, but also for additions to distribution lines.

Output Overshoots 1929



Rising sharply from the usual holiday sag, electrical energy production for the week ended January 12 broke all records for the week except 1930, and it missed 1930 by only 2.4 per cent. Reported by the Edison Electric Institute as 1,772,609,000 kw.-hr., it exceeded that of the like period a year ago by the wide margin of 7.7 per cent, surpassed even the figure for 1929 by 2.2 per cent and left the lower outputs of the intervening years far behind.

Compared with the output two years ago there has been a recovery of 18.5 per cent. The temporary decline due to the holidays was much smaller than at the end of 1929. The first full week in January was almost up to the highest in December, which is unusual. In short, a rising tide of industrial activity seems to be piling up on top of the mid-winter lighting load.

The chief manufacturing regions continue well ahead of the preceding year, as is evident from the table.

Weekly Output, Millions of Kw.-Hr.

1935	1934	1933
Jan. 12...1,773	Jan. 13...1,646	Jan. 14...1,495
Jan. 5...1,669	Jan. 6...1,564	Jan. 7...1,426
1934	**1933**	**1932**
Dec. 29...1,650	Dec. 30...1,539	Dec. 31...1,415
Dec. 22...1,788	Dec. 23...1,657	Dec. 24...1,554
Dec. 15...1,767	Dec. 16...1,644	Dec. 17...1,563
Dec. 8...1,743	Dec. 9...1,619	Dec. 10...1,519

Per Cent Change from Previous Year

Region	Week ended Jan. 12	Jan. 5	Dec. 29
New England	+ 7.7	+ 5.9	+ 6.4
Middle Atlantic	+ 5.4	+ 2.9	+ 4.7
Central Industrial	+ 8.7	+ 6.9	+ 7.5
West Central	+ 4.1	+ 1.0	+ 5.3
Southern States	+ 9.4	+15.9	+13.8
Rocky Mountain	+12.0	+ 5.8	+ 9.6
Pacific Coast	+ 6.0	+ 4.0	+ 2.9
United States	+ 7.7	+ 6.7	+ 7.2

Laclede Utility to Build $2,000,000 Power Plant

Plans for the construction of an additional power plant by the Laclede Power & Light Company within the next 1 1-2 years that will more than double its electrical power-producing facilities in the city of St. Louis have been announced by Edward P. Gosling, president. The Laclede Power & Light Company is a subsidiary of the Utilities Power & Light Corporation.

The new plant, which cost approximately $2,000,000, will be equipped at first with two 15,000-kw. generators. There will be three 1,350-hp. boilers, built to burn natural gas, oil and, eventually, powdered fuel. The plant will be built on ground already owned by the Laclede Company. The work will be done by the Management & Engineering Corporation, another subsidiary of the Utilities Power & Light Corporation, Mr. Gosling stated.

General Electric Orders Increased 29 per Cent

Orders received by the General Electric Company during the year 1934 amounted to $183,660,303, compared with $142,770,791 for 1933, an increase of 29 per cent, President Gerard Swope announced this week.

Orders for the quarter ended December 31 amounted to $51,046,760, compared with $37,985,790 for the last quarter of 1933, an increase of 34 per cent.

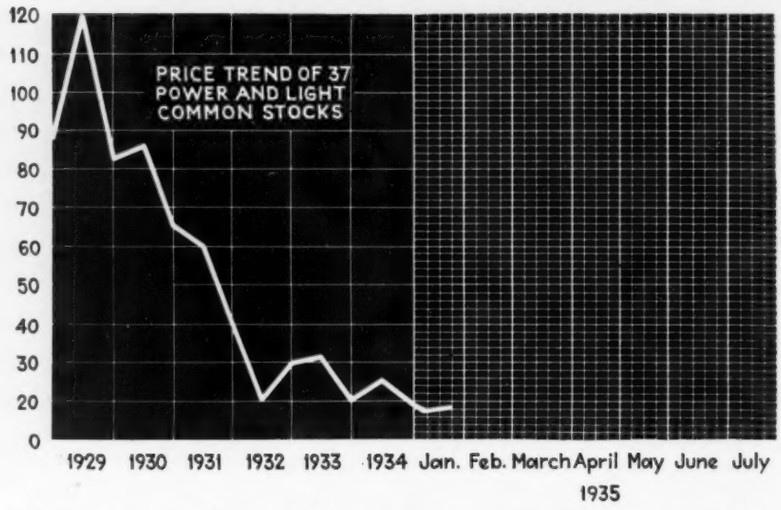
Sales billed and earnings for the year 1934 are not yet available. The complete annual report will be issued in March.

•

Radio Stock Dividend Voted by Westinghouse

Directors of the Westinghouse Electric & Manufacturing Company have declared a dividend consisting of one-quarter of a share of common stock of Radio Corporation of America for each share of preferred stock and common stock of the company, payable February 18 to stockholders of record at the close of business on January 21. In view of the preferential rights of the preferred stock of the company, the directors also declared an optional dividend of $3.50 per share upon any share of the company's preferred stock, the holder having the option to accept such cash dividend in exchange for the quarter share of common stock of the Radio Corporation. This dividend, including the optional feature, constitutes as to holders of preferred stock full payment of preferential dividends for the year 1935 to which holders of such preferred stock are entitled.

Utility Stocks Advance Slightly



Common stocks of electric light and power companies have moved slightly upward since the beginning of the year. "Electrical World" index, first week in January 18.4; this week 18.6

Niagara Hudson Plans Lower Rate Schedules

Executives of the operating utility companies affiliated with the Niagara Hudson System have proposed a new program of simplified cheap electric rates of the "yardstick" type. The goal of the program is to approach as far as possible the low rates which are now in effect in Buffalo and along the Niagara frontier.

"A feature of the plan," the announcement said, "is the adoption of an objective form of rate for residential and farm users similar to that successfully employed in several Southern states. This is based on the promotion of greater use of electricity by immediately passing the resultant savings on to the customer. Thus, any householder or farmer enjoys two advantages. He can obtain extra kilowatt-hours for the amount he now pays or by virtue of the new low rates he can substantially increase his present use by a slight additional cost.

"It is now felt," the announcement continues, "that improving economic conditions make it possible for the public to use more electricity. Therefore, an acceleration of the previous policy of rate reductions should make for greater use and this, in turn, permit even lower rates as consumption rises.

•

Winnipeg Plan Accepted by Security Holders

After one year of negotiations the reorganization plan of the Winnipeg Electric Company and its affiliates has been agreed upon by the shareholders and bondholders. Assets are represented by investments of $75,000,000 originally. The new set-up calls for an issue of $50,000,000 general mortgage bonds, secured by the combined properties. The new company will be known as Winnipeg Electric Corporation. Under the new set-up the annual fixed charges will be reduced approximately one-half.

Current Earnings Reports

Operating Companies

	1934	1933
Alabama Power (Year to Nov. 30)		
Gross earnings	$15,402,476	$15,519,566
Net balance	537,432	884,357
Consol. Gas, Elec. Lt. &, Pwr. (Balti.) (11 mos ended Nov. 30)		
Gross earnings	26,326,540	24,925,130
Net balance	4,284,451	4,117,748
Detroit Edison (Year ended Nov. 30)		
Gross earnings	44,623,645	41,463,009
Net balance	6,941,412	6,444,534
Georgia Power (Year ended Nov. 30)		
Gross earnings	22,075,400	22,129,019
Net balance	969,558	2,284,900
Kansas City Pwr. & Lt. (Year ended Nov. 30)		
Gross earnings	14,710,314	14,216,739
Net balance*	3,337,161	3,260,488
Pennsylvania Pwr. & Lt. (Year ended Nov. 30)		
Gross earnings	34,052,031	32,810,019
Net balance	5,411,928	5,505,575
Puget Sound Pwr. & Lt. (Year ended Oct. 31)		
Gross earnings	13,143,465	12,612,256
Net balance	1,535,320†	969,909†
Virginia Elec. & Pwr. (Year ended Oct. 31)		
Gross earnings	15,053,815	14,700,460
Net balance	1,480,813	2,154,716

Holding Companies

	1934	1933
American Pwr. & Lt. & subs. (Year ended Nov. 30)		
Gross earnings	$75,771,815	$73,200,364
Net balance	3,670,926	4,680,849
Commonwealth&Southern & subs. (Year ended Nov. 30)		
Gross earnings	114,562,788	108,729,206
Net balance	760,582†	732,912†
Electric Power & Light & subs. (Year ended Nov. 30)		
Gross earnings	73,546,551	68,296,055
Net balance	338,422†	1,276,924†
Engineers Public Service & const. cos. (Year ended Nov. 30)		
Gross earnings	44,245,950	42,472,130
Net balance	1,351,436†	579,630†
National Pwr. & Light & subs. (Year ended Nov. 30)		
Gross earnings	71,789,665	68,564,279
Net balance	6,791,370	6,782,194
Public Service Corp. of N. J. & subs. (Year ended Nov. 30)		
Gross earnings	120,327,006	117,050,0943
Net balance*	24,725,073	26,729,239

*Available for all dividends. †Deficit.

Gross earnings—(Operating Companies) Gross operating revenue. (Holding Companies) Gross operating revenue plus other income. Net balance—Balance available from income for common stock dividends.

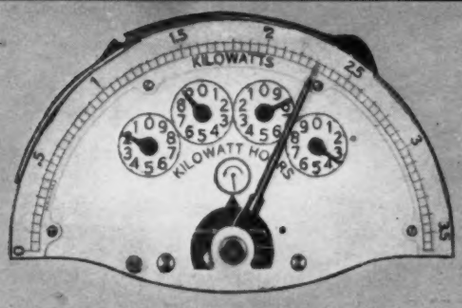
New York Metal Prices

	Jan. 2, 1935 Cents per Pound	Jan. 16, 1935 Cents per Pound
Copper, electrolytic	9.00*	9.00*
Lead, Am. S. & R. Price	3.70	3.70
Antimony	13.625	14.25
Nickel ingot	35.00	35.00
Zinc, spot	4.075	4.10
Tin Straits	50.80	50.50
Aluminum, 99 per cent	23.30	19—21

*Blue Eagle.

DEMAND METERING

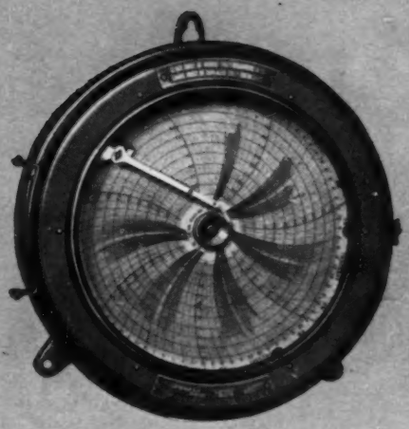
Maximum demand is indicated by this dependable, contact-operated demand meter, Type M-16 for a-c. or M-19 for d-c. Used in conjunction with a watthour meter.



TYPE M-20

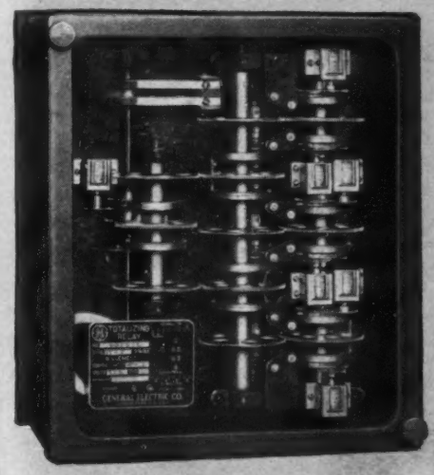
Installed as an integral part of a watthour meter, this substantial register, Type M-20 (a-c.), indicates maximum demand and registers kilowatt-hours.

For indicated maximum demand combined with a cumulative record of the demand, a new register (Type M-21) is available. The demand is determined from a set of dials by subtracting the previous reading from the present reading.

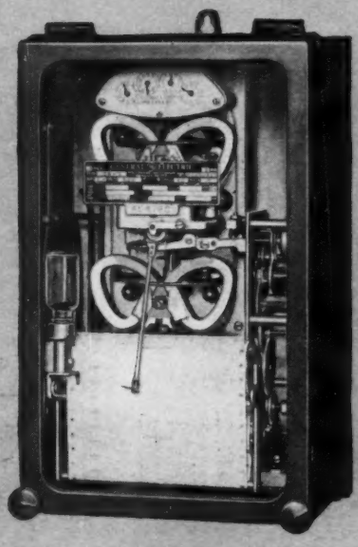


A graphic record of the demand is made by this contact-operated demand meter, Type G-9 (a-c. or d-c.). Used in conjunction with a watthour meter.

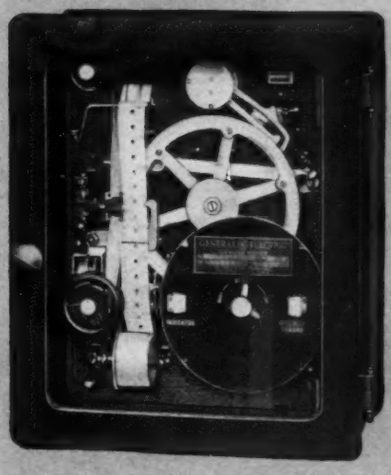
Demand is totalized by this moderately priced, 2-circuit, a-c. or d-c. relay, Type DJ-2. Used in conjunction with a watthour meter and an indicating, contact-operated demand meter.



Demand of any number of circuits is totalized by one or more of these multicircuit, a-c. or d-c. relays, Type DT-3. Used in conjunction with a watthour meter and a printing (recording), contact-operated demand meter.



A graphic record of the demand is made on a 6-inch strip chart with this high-quality combined a-c. watthour and demand meter, Type DG-1 or DG-2.



A printed record of the demand is produced by this contact-operated demand meter, Type PD-5 (a-c. or d-c.). Used in conjunction with a watthour meter and a time-interval (contact-making) clock.

These Devices Will Give You the FACTS You Need

What do YOU require of a demand meter? Do you need to know only the peak of the month? Or must you be able to tell how and when the peaks occurred and have a definite record of the demands? Or do you need even more comprehensive information—as, for example, totalized demand?

Whatever your demand-metering problems are, however complex, G.E. offers a solution in its complete line of meters and registers. Moreover, it extends to you the services of its meter specialists and engineers, who have had wide experience with demand metering. Address the nearest G-E office, or General Electric, Schenectady, N. Y.

410-4

GENERAL ELECTRIC

"Tax-free" Municipal Skimps Depreciation

When press proponents of a municipal plant question the management's policy of letting the plant deteriorate so as to feed over a million dollars a year into the city treasury, the practice certainly bears scrutiny. Experts have recently reported to the city authorities of Jacksonville, Florida, that it will be necessary to spend $2,454,000 in the next five years to renovate the system. City Commissioner Anders has been saying that the plant has contributed $1,300,000 a year for five years to tax reduction. The Jacksonville *Journal* says $500,000 of this should manifestly have been put back into the system each year and whatever the taxpayers saved they must now restore to "pay the fiddler."

The Schofield and Taylor engineering firms bear out in late 1934 what ELECTRICAL WORLD intimated in early 1932 would happen if depreciation continued to be slighted to make a striking show of earnings (January 30 issue, W. Austin Smith, author).

•

Washer Shipments in 1934

Household washer factory shipments in November totaled 76,206 units, an increase of 8 per cent over 70,118 in November, 1933. According to figures for the industry reported by J. R. Bohnen, secretary of the American Washing Machine Manufacturers' Association, this brings the eleven month total to 1,164,921 and reveals that 1934 shipments will exceed 1,200,000, the highest in the industry's history. Ironer shipments for 1934 are expected to attain a total of 110,000, compared to 69,991 in 1933.

•

To Eliminate Radio Noises

The Radio Manufacturers' Association, working through the committee on interference of its engineering division, has launched one of the most important campaigns in the history of radio broadcasting. It is the purpose of the campaign to reduce in all parts of the United States electrical noises heard in radio reception due to man-made devices. The committee on interference will work in co-operation with other interested electrical and radio organizations.

•

More Extensive Uses for Heat-Resistant Alloys

The general upturn of industrial activity and the growing tendency to install a special heating unit for a special purpose have both contributed largely to the 127 per cent increase in 1934 in the production of heat-resistant alloys over 1933, according to Robert C. Stanley, president of the International Nickel Company of Canada, Ltd., in his annual survey of the nickel industry for 1934.

Another factor in the increased use of heat-resistant materials has been the formulation of a broad classification for this type of metal by the Code Authority of the industry in the United States, which has helped purchasers to order and the manufacturers to provide materials to definite specifications. The consumption of nickel in nickel-chromium electrical resistance wire is constantly growing with the increase in the number and types of electrical appliances.

•

Deposits Must Be Returned by Utilities, Court Rules

Justice Gilbert V. Schenck of the Supreme Court, Albany, upheld last week the constitutionality of the new law requiring utility companies to return consumers' deposits on demand, at the expiration of stated periods to report to the New York Public Service Commission deposits unclaimed for ten years, and to pay into the state treasury deposits unclaimed for fifteen years with interest. The case will be carried to the Court of Appeals. If Justice Schenck's decision is upheld it will mean that the utility companies of the state will be forced to surrender a sum estimated up to $30,000,000. Under the new law, which was enacted last year as part of Governor Herbert H. Lehman's utility regulation program, the state would retain three-fourths of the amount returned on deposits unclaimed for fifteen years, the remaining one-fourth to be paid into a special fund to protect the companies for payment of future claims on dormant deposits.

The companies which brought suit are the Brooklyn Gas Company, Rochester Gas & Electric Corporation, Kings County Light Company, New York & Richmond Gas Company, Union Gas Company, Buffalo General Electric Company, Long Island Lighting Company, New York Edison Company and the Consolidated Gas Company of New York.

•

City Plant Denied Right to Extend Lines Outside

Holding that the municipality had no legal right to extend the distribution system outside its own corporate limits, the Missouri Supreme Court sustained last week the injunction restraining the municipal light and power plant of Shelbina from building such an electric transmission line. Shelbina had entered into a contract to build a transmission line to supply electric energy to Lakenan, an unincorporated village five miles eastward, and it also planned to supply not only the village, but also various individuals along the proposed line. The transmission line was to be financed out of earnings. The Circuit Court granted the injunction sought by certain taxpayer-residents of Shelbina and the city then appealed to the Supreme Court.

750-TON REFRIGERATOR FOR SOUTH AFRICA

Keystone

Equal in capacity to 12,000 domestic refrigerators, this huge Carrier centrifugal refrigerator makes 2,500 gal. of ice water per minute. It is shown prior to shipment to South Africa, where it will be used on one of the world's deepest mines, the Robinson Deep, a gold mine penetrating 8,380 ft. into the earth. Air, cooled over the water, will be forced into the mine so that the workmen can have better ventilation

With the New Oil-Circuit Recloser You Can

REDUCE LINE MAINTENANCE
IMPROVE SERVICE—
GET BETTER PROTECTION

on outlying and low-capacity lines

Here's Why: The oil circuit recloser provides all the advantages of larger automatic reclosing equipments for lines which produce small revenues. When a fault occurs, the recloser clears the line and then automatically recloses. After reclosure if the fault is cleared, it resets for another complete duty cycle. It will clear any number of momentary faults without attention and with minimum service outage. On sustained faults it locks out after a predetermined number of reclosures. It will reduce patrol work and confine service outages to the short-circuited line. ● Here is the answer to the problem of automatic fault protection for your outlying and low-capacity lines. For details, ask for Bulletin GEA-2003. Address the nearest G-E office, or General Electric, Dept. 6—-201, Schenectady, N. Y.

810-53

GENERAL ELECTRIC

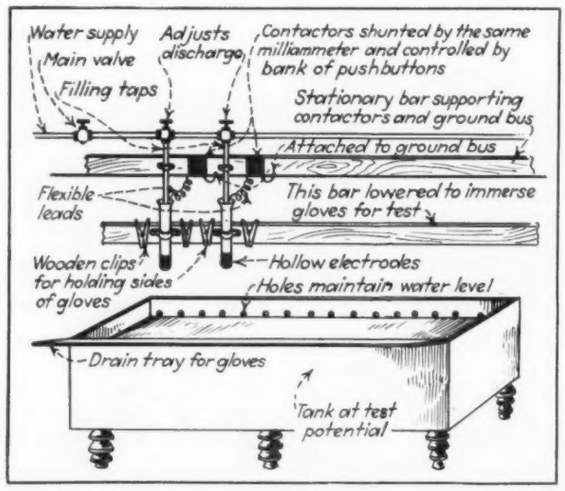
Expedites Rubber Glove Testing

Some refinements in facilities that expedite rubber glove testing are employed by one company and are illustrated herewith. In most laboratories the gloves are filled and immersed in a tank of water maintained at ground potential, the individual electrodes inside each glove being energized at test potential. To test leakage current the milliammeter circuit and contactor must be insulated for test potential. These conditions do not exist with the revised equipment considered.

The tank is energized at test potential, whereas the individual electrodes are connected to ground through separate contactors, each controlled from a bank of push buttons adjacent to a milliammeter shunting each contactor. As a result the contactors, their control circuits and the milliammeter do not have to be insulated for high voltage to ground. Furthermore, leakage-current tests can be made as fast as the operator can push the successive push buttons and read the meter.

Proper immersion of the gloves, inside and outside, is assured by several precautions. For example, a horizontal line of holes near the top of the tank limits the water level, even though the water in tested gloves is dumped into the tank. The taps for filling each glove are connected to a common water supply line, containing a valve, and additional valves are provided in each tap to equalize the discharge. As indicated, the taps discharge into the gloves through the hollow electrodes when they are in the raised position for attaching the gloves to the wooden clips.

After the gloves are tested and emptied they are laid on an inclined tray alongside the tank so they will drain into the latter. They are finally dried by slipping over vertical wire forms that allow a jet of compressed air to blow into and around the gloves.


Water supply
Main valve
Filling taps
Adjusts discharge
Contactors shunted by the same milliammeter and controlled by bank of push buttons
Stationary bar supporting contactors and ground bus
Attached to ground bus
Flexible leads
This bar lowered to immerse gloves for test
Wooden clips for holding sides of gloves
Hollow electrodes
Holes maintain water level
Drain tray for gloves
Tank at test potential

Some features of glove-testing equipment

Shunted across the contactors in each glove-electrode circuit is a single milliammeter which shows the leakage current of each glove when the banked push-buttons controlling the contactors are pushed successively.

•

Manholes Protected by Telltale

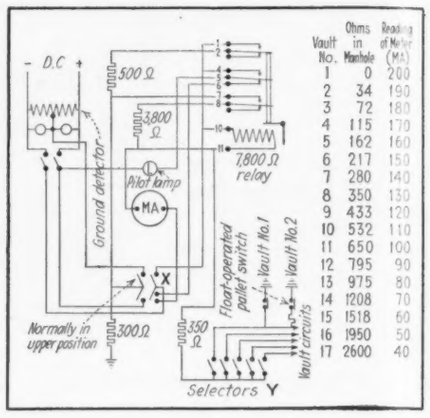
By A. P. SESSIONS
Distribution Substation Engineer
Southern California Edison Company, Ltd.
Los Angeles, Calif.

An installation which shows promise of accomplishing all that is desired by the expenditure of very little money was recently made at one of the Southern California Edison Company's substations.

Previously some 85 manholes in the underground system fed by this substation were supervised by a high-water telltale system reporting to this station. In each manhole was a copper float operating a pallet switch which would make contact between a signal wire and ground if water should rise. The 85 manholes were divided among five separate signal circuits—seventeen holes per circuit—each containing a knife switch mounted in the substation so the operator could identify which group was sending the alarm.

Inasmuch as this system did not indicate which one of the seventeen manholes on any one circuit might be in trouble, the system was changed to permit identification of the specific manhole requiring attention. This saves much time and cost previously consumed by having to open several manholes before finding the right one. The change cost less than $1 per manhole because much equipment already installed was utilized.

An existing d.c. ground detector was utilized by connecting resistors on each side of the station battery feed to the telltale system to avoid currents that would trip any circuit breaker, even though drawn through an accidentally grounded trip coil. A d.c. voltmeter was converted into a 200-m.a. milliameter and vitrified resistors, rang-

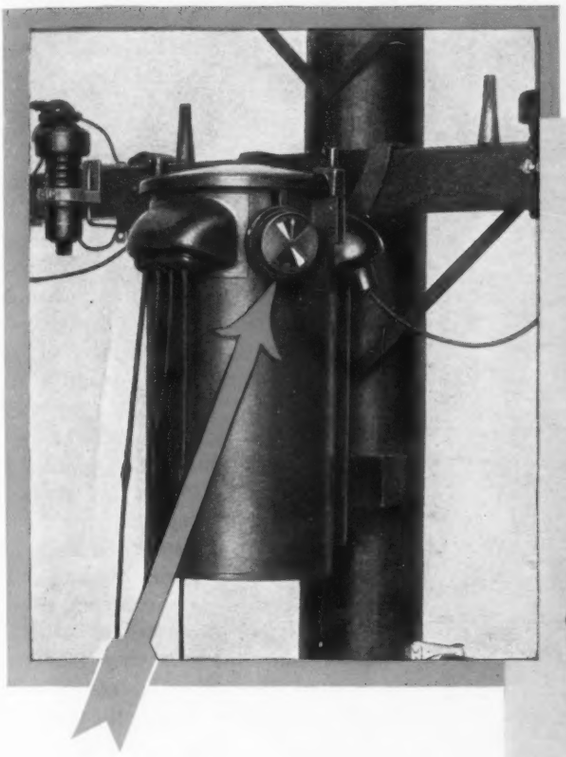


Shows which of 85 manholes is flooded

When vault contact closes, relay picks up and seals in through contacts 7 and 8 and the 3,800-ohm resistor; the pilot lamp is lighted through contacts 4 and 5, and "battery negative" is grounded through contacts 1 and 2 and 500-ohm resistor. This will operate ground detector and ring alarm.

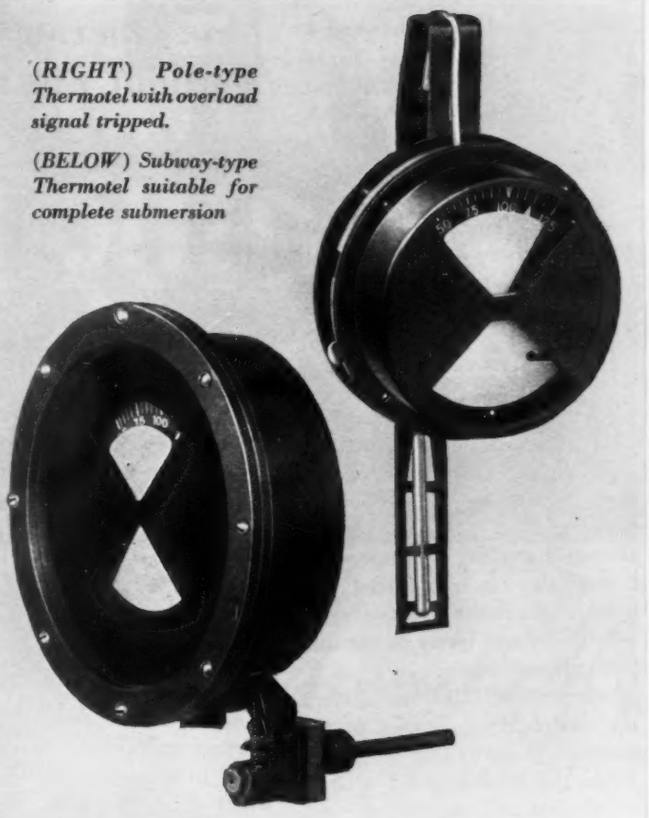
Then switch *X* should be thrown to lower position, causing relay to drop out and stop bell, ground battery "positive" through 300-ohm resistor, and connect meter between battery negative and vaults. Pilot lamp will be lighted through extra clip on switch *X* and contacts 5 and 6.

Vault selector switches *Y* should then be opened in succession to determine manhole in trouble. With only the selector of this circuit closed, read meter to determine vault in trouble.



(RIGHT) Pole-type Thermotel with overload signal tripped.

(BELOW) Subway-type Thermotel suitable for complete submersion



Do you KNOW the margin of available capacity?

WHY not be certain of the efficiency of application of your distribution transformers? The Thermotel SHOWS AT A GLANCE★ the relation between the load requirement and the available transformer capacity. Installed on each transformer, it will help you during the winter peaks and prevent interruptions to service.

You can apply the Thermotel to G-E distribution transformers as small as 1½ kv-a. and as large as 200 kv-a. Adjustment for transformers of different sizes is effected simply by shifting an external lever. Installation requires but a few minutes.

Bulletin GEA-309D gives a complete description of the Thermotel, including a new subway-type unit. If you would like a copy, address the nearest G-E sales office or General Electric, Dept. 6A-201, Schenectady, N. Y.

★The Thermotel indicates directly the per cent of available transformer capacity actually being used. This is possible because the Thermotel automatically corrects for ambient temperature.

330-238

GENERAL ELECTRIC

ing from 35 to 2,600 ohms in seventeen steps, installed in each group of manholes between the signal light and the float switch. A telephone-type bank of contact relays was mounted on the substation panel and connected as shown. The telephone relay is adjusted to make contact if four milliamperes or more flow, so that if leakage currents of this value develop the operator can clear them. Since the signal-current differential from one manhole to the next is 10 milliamperes, this guarantees that leakage will be maintained at a sufficiently low value to prevent incorrect indication from this source.

How telltale is used

After a trouble signal is received switch *X* is thrown into the lower position and by opening the selector switches *Y* in succession, the operator can determine the specific manhole by the milliameter reading corresponding to that manhole. It is assumed that two or more manholes on the same signal circuit are not likely to get into trouble simultaneously.

If the meter indicates no current when the switch *X* is thrown to the down position, it shows that the signal came from the underground telltale system, but that the contact was not retained. If some one is working in the vaults the operator would have been previously advised and can call the workman over the telephone line which loops around all manholes in the same cable with the signal wire. If there should be no one working in manholes the operator would report the momentary contact to the distribution organization for attention.

If the alarm rings, and the d.c. ground-detector indicates a ground, but the pilot lamp on the telltale panel does not light, the operator knows that the signal has been initiated by a ground on his station-control wiring. If when switch *X* is swung to the lower position, the meter indicates something less than 40 milliamperes (less signal current than would correspond to any manhole), the operator knows that a leakage ground has been established and so reports.

Variation in contact resistance is not likely to cause incorrect indication in this system since wiping-contact pallet switches are used on the floats. There is very little change of contact resistance reaching as high a value as 35 ohms, which is near the signal current for No. 1 manhole, or 2,600 ohms, corresponding to No. 17 manhole, which would be necessary to produce incorrect signals.

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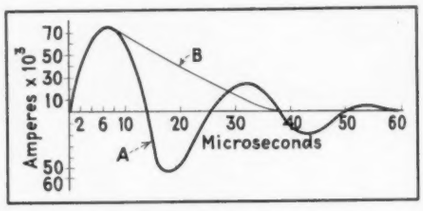
Line Operates Year Without Flashover

By F. S. DOUGLASS
Electrical Engineer,
Management & Engineering Corporation,
Chicago

Practical immunity to lightning flashover has apparently been conferred* on the Interstate Power Com-



Test surge reached 75,000 amp.

Curve A was plotted from a cathode-ray oscillogram of the discharge that split a tube under test. Curve B is the equivalent aperiodic discharge, determined by making the area under curve B equal to the total area between curve A and the x-axis.

pany's transmission line between Clinton and Dubuque, Iowa, by Deïon tube protectors. Installation of the tubes was started in 1931 and completed during the winter of 1932-33, the majority of them being installed between August 1, 1932, and December 31, 1932. From January 1, 1931, to the date of writing operating records of the line show the following:

	Flashovers
1931, January 1—December 31 ...	34
1932, January 1—August 1	26
1932, August 1—December 31.....	3
1933, January 1—December 31....	3
1934, January 1—December 10...	0

Comparison of the number of flashovers with the dates of installation of the tubes shows how the number of flashovers decreased as the tube installation progressed, until in 1933 and 1934, when all the tubes were in service, the number of flashovers decreased to three in two years. Two tube failures were experienced in 1933, one of which resulted in an interruption to the line. In both cases the tubes were burst as from internal pressure. Inspection of the burst tubes indicated that their failure was caused by excessive surge current rather than from follow current as the electrodes showed little or no evidence of burning.

*See ELECTRICAL WORLD, June 24, 1933, "Rehabilitated Transmission Line Defies Lightning."

It was felt that if the surge current necessary to destroy these tubes were ascertained, this information, with their time in service on the Clinton-Dubuque line, would furnish some very definite and valuable data on the probability of occurrence of current-time discharges above a certain figure in a given length of time. Consequently, two tubes of the same construction as those that failed were tested on a heavy current-surge generator. Because the voltage of the generator was not high enough to discharge through the tube, the gap inside of the tube was short circuited by a very fine wire which was exploded by the surge, thus allowing the surge to develop in the gas space.

One of the tubes split and the other tube withstood several discharges of the magnitude shown in accompanying diagram. The tubes which failed in service indicated that they had been subjected to currents considerably higher than those used in the test. Apparently two surges exceeding the test current-time magnitude have occurred since the tubes were put in service, or in approximately 2½ years.

These data obtained from the Clinton-Dubuque line are of special value because there is practically no chance of a surge current going anywhere but through a tube. Hence a great many of the variables which exist in studies on unprotected line are eliminated.

•

Fence Regalvanizing Less Than Painting

After five to seven years' service a company found that its fences around power station and substation property needed repair or replacement. The means of restoring the fence were studied and, strange as it may seem to many, it was reported most economical to take down the old fence and have it regalvanized. The figures which justified that decision are as follows:

	Dollars per Lineal Foot	Life of Material (Years)
Install new 6-ft. high galvanized fence.....	3.12	5 to 7
Take down existing fence, regalvanize, replace. (Cost includes labor, 50% new bolts of non-rust type, new bands and painting of posts).....	0.30	5 to 7
Paint existing fence.....	0.50	5 to 7
Replace galvanized barbed wire with aluminum barbed wire.....	0.075	5 to 7
Replace galvanized barbed wire with new galvanized barbed wire.	0.04	2½ to 3½

L-M LIQUID FUSE UNITS

Dependable!

Save Money!

NOTE THESE FEATURES!

L-M Liquid Fuse Units are foolproof, always dependable and constant in their characteristics. Improvements in their design are instantly available to you in replacement parts so that the reconditioned fuse is always of latest design.

They save money because you can recondition them yourself in your own shop, because a small stock of replacement parts makes unnecessary a large investment in spare fuse units, permits greater flexibility.

For new installations and replacements consider L-M Liquid Fuse Units.

LINE MATERIAL CO

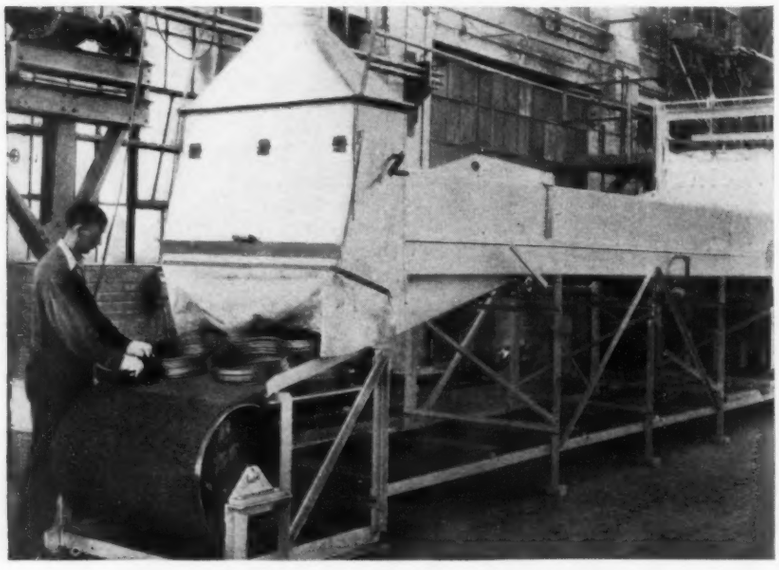
SOUTH MILWAUKEE, WISCONSIN, U. S. A.

Cuts Costs, Raises Quality and Sales

"The new electric furnace which bright-anneals our copper tubing," says President C. C. Limbocker of the Wolverine Tube Company, Detroit, "is helping us to increase sales because it has materially improved quality. Our tubing is now more uniform, and as a result of the dry-annealing feature of the furnace water spotting has been entirely eliminated. Our annealing costs have been cut in half. The cost of the electricity per pound of tubing annealed is only one-tenth of a cent.

"With this new furnace we are able to give our customers quick shipment on small orders. Its flexibility is outstanding. It handles all our products —straight and coiled tubing, finned tubes and formed pieces—whereas before we installed it three furnaces were required."

The furnace used was installed in August, 1934. It is a new General Electric controlled-atmosphere, continous, mesh-belt-type furnace. Its atmosphere is supplied by a combustion-type, furnace-atmosphere controller, which reforms a mixture of city gas and air.



Charging end of conveyor-type furnace for bright-annealing copper tubing

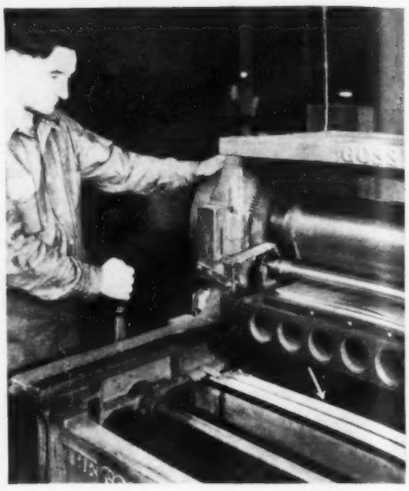
Observe portion of furnace in the right background. Capacity is 2,000 lb. per hour, 1,060 deg. F., 195 kw., 115 ft. over-all length.

•

Heated Matrix Press Solves Problem

Placing of two 1,000-watt strip heaters under the bed of each matrix press at the plant of the NEA Service, Inc., Cleveland, solved a problem encountered in winter. Zinc etchings and plates representing the various newspaper cartoons and features which this company merchandises are placed on the bed of a matrix pressing machine and "mats" are rolled out. These mats are sheets of cardboard-like substance which, when pressed damp, take a deep impression from which the individual newspapers can cast illustrations in type metal.

Two of the mat-rolling machines are near windows with a northern exposure. In winter the company has experienced much trouble due to chilling of the moisture in the mats when the latter came into contact with the cold press-bed. This problem was solved by the installation of two strip heaters under the bed of each press.



Strip heaters prevent chilling of mats

•

Balancing Demands for Economy

Economy in balancing the energy requirements for heat and power is carefully planned in serving Sears, Roebuck & Company's headquarters in Los Angeles, Calif. In this multi-story merchandising establishment heating is supplied by steam, lighting by electricity and major power by dual drives—both motor and turbine. The reason for this drive is apparent from the following:

Both natural gas for firing the boilers and electric energy are purchased, and it is the endeavor of the management to obtain the most favorable unit rate on each to obtain a maximum over-all economy. Because heating is required only during a small portion of the year, generating electricity as a byproduct of the heating plant would require that the steam plant operate throughout the year even when steam was required for no other purpose. While this would have enabled the company to obtain a low gas rate on a quantity basis, the combination of steam generation and purchased

Far Speaking TOWERS

Center: 230-foot radio tower terminating in a single mast, fabricated and erected by American Bridge Company in northern Wisconsin.

Right: One of two 200-foot A.B.C.—constructed radio towers at Fort Brown, Texas, shown completed and with antennae in place.

Left: Twelve specially designed 400-foot radio towers with 150-foot cross arms, designed, fabricated and erected by American Bridge Company, for the Radio Corporation of America at Rocky Point, L. I.

RADIO TOWERS—singly or in stands of a dozen or more, high, strong, of balanced construction and nicely adapted to their intended use—have been a specialty of the tower department of American Bridge Company for many years. A technically trained and widely experienced personnel commands resource in design to meet all conditions that may be involved for any broadcasting project. Modern fabricating and erecting equipment and ample facilities of every kind required, assure a finished structure economically built as well as of adequate strength.

The diversified knowledge of American Bridge Company technicians concerning towers for other uses, from the simplest type of transmission tower to the most complicated sub-station, is always at command to assist in the study of special difficulties or requirements.

AMERICAN BRIDGE COMPANY

SUBSIDIARY OF UNITED STATES STEEL CORPORATION

General Office: Frick Building, Pittsburgh, Pennsylvania

Contracting Offices: Baltimore, Boston, Chicago, Cincinnati, Cleveland, Denver, Detroit, Duluth, Minneapolis, New York, Philadelphia, Pittsburgh, St. Louis, Salt Lake City.

Pacific Coast Distributors: Columbia Steel Company, Russ Building, San Francisco *Export Distributors:* United States Steel Products Company, New York

energy proved more favorable from a financial standpoint. Inasmuch as steam heating, when required, necessitated a boiler-plant installation, a combination of steam and electricity drive was worked out.

Under normal conditions gas is converted either into heat or mechanical energy through the turbine drives until the quantity used equals the amount that is necessary to qualify for the low-cost blocks provided by the gas rate. Then major drives are transferred to electric operation to take advantage of the low cost per unit of energy possible in the block electric rate and thereby bring down the unit cost of electrical energy for the building as a whole.

To prevent excess demand charges on the electric rate, an overcurrent alarm and a three-minute time-delay trip will operate in case the electric demand exceeds a specified maximum. When the alarm sounds the operator transfers some of the electric load back to steam operation until such time as the danger of exceeding the maximum demand is passed. In case the operator fails to correct the situation, the major power circuits will be tripped out automatically.

In this manner maximum advantage is taken of favorable rates for both gas and electricity, demand charges are kept to a minimum, and an extremely flexible power supply system is provided. The additional investment in dual drives for major equipment is reported to be more than balanced by the greater reliability and additional economy of the system. These advantages are attained without the capital and operating costs of an individual generating plant. From the utility standpoint, it limits the arguments for isolated plants in commercial establishments.

•

Mountainside Quarry Floodlighted

By FRANCIS A. WESTBROOK
Consulting Engineer,
Center Conway, N. H.

Floodlighting for night operations became necessary when the Maine & New Hampshire Granite Corporation of Redstone, N. H., took the order to supply Conway pink granite for the new New York postoffice annex. The quarry is a mountainside surface operation. Unusual handling of the lighting was necessary to illuminate the upper levels as the removal progresses up the slope.

Elevated lamps needed to illuminate rising quarry operations

Ample light obtained by extending pole tops and by utilizing peaks of derrick masts for mounting swiveled fixtures. BXL used for pole runs and hired distributors.

Floodlights were installed on wood poles, on top of the hoisting engine houses and in one case on the face of the cliff. Five 1,000-watt and five 500-watt standard "Ivanhoe" floodlighting fixtures have been installed. The 1,000-watt units are catalogue No. 1268 with Mogul base and the 500-watt fixtures are catalogue No. 1066 with swivel assemblies. These lights are served by two circuits about evenly divided as to load and each protected by a 60-amp. Square D switch which also controls all the lights on the circuit.

Conductors are run underground because of the overhead network of steel guy ropes for the derricks, and the movements of the derrick booms and the frequent relocation of the derricks. Three-conductor BXL cable was used for the underground runs and the runs up the poles to the lighting fixtures. It is buried directly in the ground without conduit. The trenches are merely deep enough to get the cables out of the way and safe from injury. The conductors are No. 4 A.W.G. with flexible stranding, so that they are not difficult to handle.

Moving Products to Destination

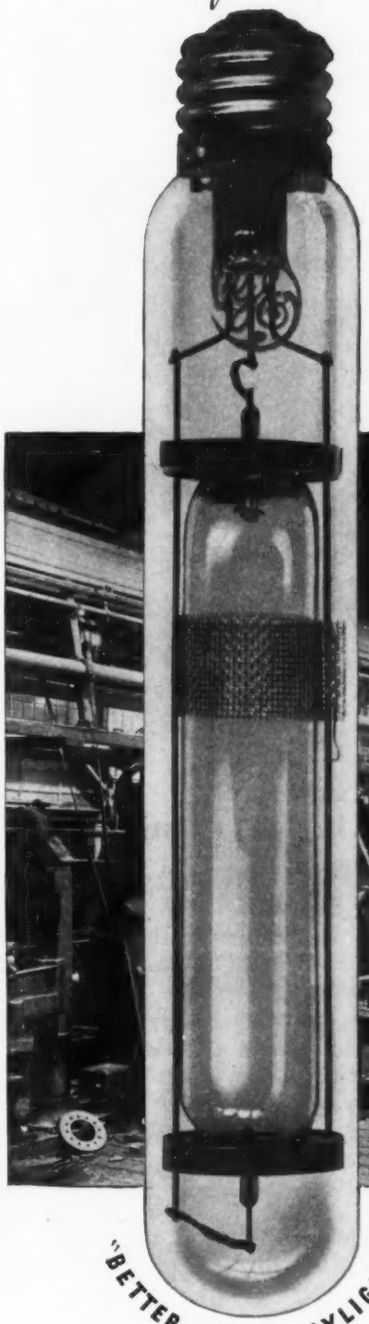
Battery-tractors with automatic-coupling trailers simplify material handling

Battery-operated tractors capable of hauling more than a dozen loaded trailers and electric elevators which will accommodate the largest street trucks constitute the major part of the freight-handling equipment at Inland Terminal No. 1, Port of New York Authority. "Keeping the freight on wheels," from the time it is received at the freight car or ship until it arrives at consignee's stockroom or any floor of the terminal, or vice versa, is the key to avoiding delays, says Col. P. L. Gerhardt, industrial consultant of the terminal.

The entire contents of a freight car can be hauled to its destination on a single train of trailers. With the battery-tractors and automatic-coupling trailers the latter can be rapidly separated into groups and backed into the enormous elevators, hoisted as many as fifteen floors in 30 seconds, where they are taken off and moved to their destination by a tractor. In this way it is possible to keep transportation equipment in use such a large portion of the time that fixed charges on investment during idle hours are very small.

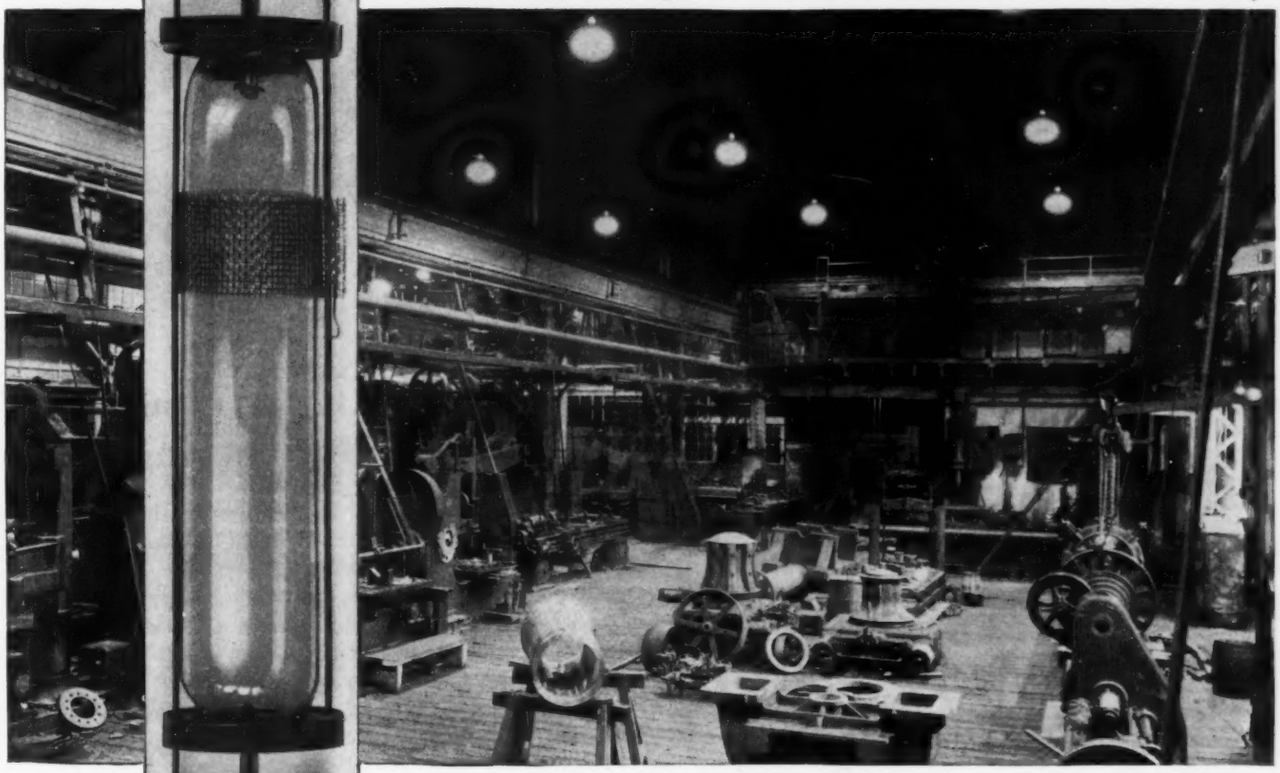
An important contribution to high bay lighting

...*the* G. E. HIGH INTENSITY MERCURY VAPOR LAMP



Industrial illumination is a production tool. Like every other production tool, it must be designed for its specific job, not merely to provide adequate intensity but what is more important to assure essential quality.

35 lumens per watt assure both sufficient and efficient intensity for the high bays. Compare this with your own, then judge. But the G. E. High Intensity Mercury Vapor Lamp with its whiter sensation adds—better light for better sight. It illuminates the shadows with its penetrating power increasing the rate of eye response and minimizing eye fatigue; increasing production quality while minimizing accident hazards. This better light means better sight—and better and more economical production . . . General Electric Vapor Lamp Company, 805 Adams Street, Hoboken, N. J.



The story of "Better Lighting For High Bays" is briefly told in this bulletin. Write for a copy.

GENERAL ELECTRIC VAPOR LAMP COMPANY

605 Copr. 1934, General Electric Vapor Lamp Co.

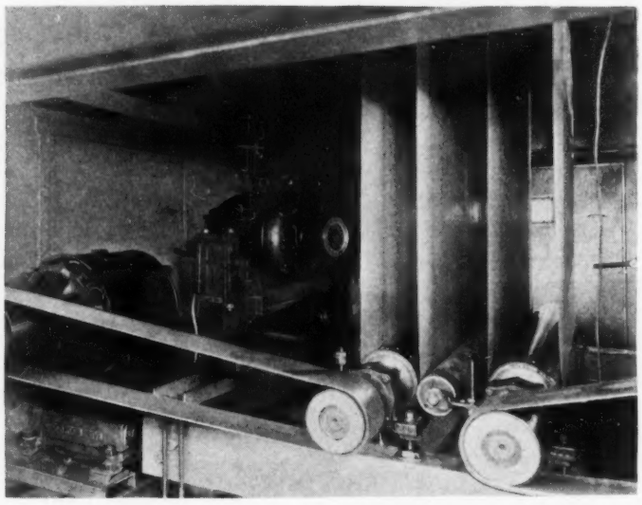
Power Drives Serve "Tech" D.C. Generator

Since the initial demonstration of the Van de Graaf electrostatic direct-current mega-volt generator last fall at the Round Hill research station of the Massachusetts Institute of Technology, when a maximum discharge potential of about 7,000,000 volts* was attained inside the hangar housing the outfit, much interest has been manifested in the method of driving the new "siege gun of science," as it has been called. The basic principle is the building up of electrostatic charges on moving belts carried upward from an electrifying level near the floor through insulated columns to and from spherical discharge chambers at the top of these structures. The belts are of paper, 4 ft. wide and 0.017 in. thick each, running at a tension of 1,000 lb. and having an estimated breaking load of 6,000 lb. The belt speed exceeds 60 m.p.h. and the cost of paper belting is about 2 per cent that of ordinary materials, such as leather, rubber and canvas.

The belts are charged initially by a 25-kv. kenotron set. There are two paper belts provided in the design of each unit. The standard main drive per belt is a Century 10-hp., constant-speed, three-phase induction motor, running at 1,165 r.p.m. on 220-volt service. Four motors aggregating 40 hp. therefore run the belts when the machine is in full service with across-the-line starting. The ascending belts are charged by corona from a wire 5 mils in diameter stretched 1 in. away from the belt and supplied by the kenotron. At the top of the belt run is a similar fine wire inclosed in and attached to a metal shield to collect the charges just before they reach the upper pulley. A third corona wire is used to charge the departing belt to the polarity opposite to that of the arriving belt. This charge is then collected at the lower end of the belt in the same manner as at the top and may be used to cause the "spraying" of charges of the desired sign upon the ascending belt, thus completing the cycle. The generator can be operated self-exciting after it is once in full operation. About 50 per cent of the power required to operate the belts is used to overcome windage losses and the small amount of bearing friction present. The rest, which represents useful electrical power, is required to overcome the electrostatic attractions between the charges.

As the operators, who are located within the spheres when research is under way, require both alternating and direct current at 110 volts for auxiliary purposes, including local lighting and laboratory measurements, amplifying, etc., a 3-kw. Century direct-current generator and 1-kva. Century rotary converter are available in each of the sphere chambers. The generators are vertical belt-driven by 10-hp. Century induction motors, mounted in the bases of the units, and provided with across-the-line starters. Rockwood drives are used throughout the units. The total connected motor load of the complete generator is about 60 hp. Electric heaters are provided to warm and dry the air inside the columns and to ward off condensation on their surfaces.

*See picture on page 1030, Dec. 8, 1934.

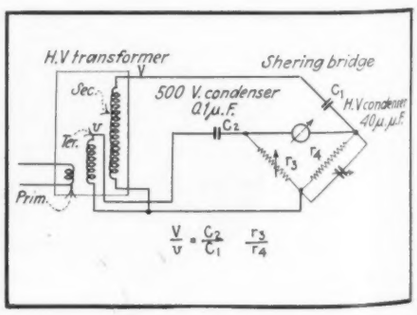


Belt drives of Van de Graaf electrostatic generator

At left, one of the main driving motors of one unit; at center rear, motor driving generator in sphere 25 ft. above. Main drive belt 4 in. wide, reduction 12 to 5, shafts 40 in. on centers. Housed inside the truck.

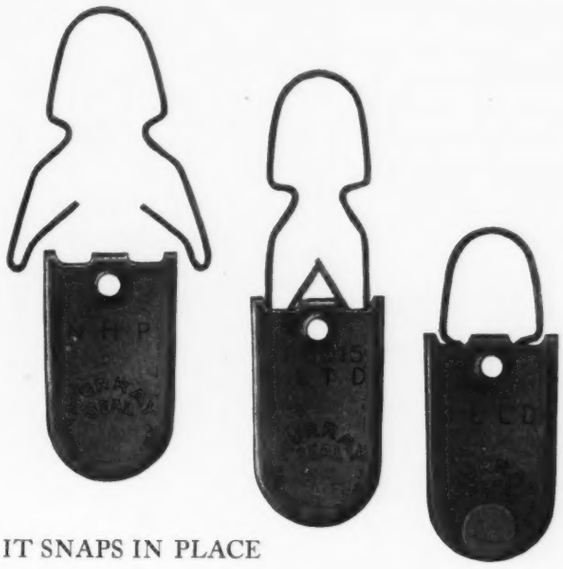
High Voltages Read by Schering Bridge

In the new high-voltage research laboratory of Callender's Cable & Construction Company, Ltd., in London the Schering bridge is being used in conjunction with a compressed gas condenser to measure the r.m.s. value of the high voltages. The tertiary (or in some instances the applied primary voltage) is applied to one arm of the bridge through a 0.1-mfd., 500-volt condenser (labeled C_2 in the illustration). The output voltage of the transformer is applied to the other arm through the 40-mmfd. gas condenser



Condensers and Schering bridge used to measure up to 1,000 kv.

NOW YOU CAN PREVENT C. D.* FROM INCREASING PROPORTIONATELY WHILE BUILDING A 2000 K. W. H. CUSTOMER LOAD



IT SNAPS IN PLACE

A LOCK WITHOUT A KEY

Every dollar spent in load building will some day return—every dollar spent in detection of current diversion gives immediate returns multipled many times over.

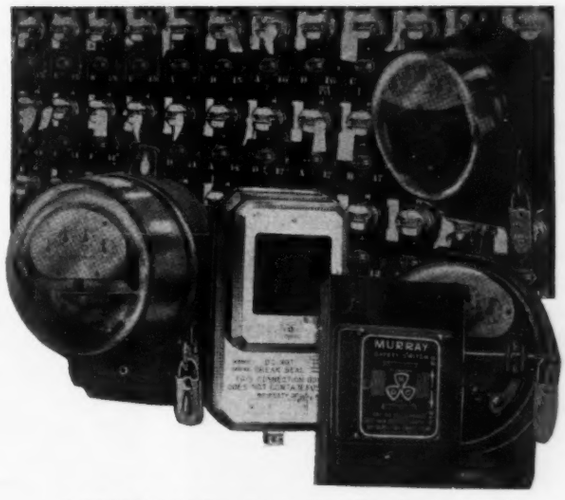
Place your dependence on the MURRAY PADLOCK SEAL. It's a real seal and cannot be tampered with. It looks and is business-like.

If the MURRAY PADLOCK SEAL was not providing thorough protection, hundreds of lighting companies would not continue to use it year after year.

Horses look alike at the starting post, you see differences when they get in action. So it is with seals. Some look alike until they are tampered with and then differences are seen.

Decide today to relentlessly attack current diversion. The coupon will bring samples and details of the Murray Padlock Seal-ing system.

SAFEGUARD YOUR PROTECTIVE EQUIPMENT WITH MURRAY PADLOCK SEALS



*CURRENT DIVERSION = INADEQUATE SEALING

METROPOLITAN DEVICE CORP.
BROOKLYN, NEW YORK

Metropolitan Device Corp'n, Brooklyn, N. Y.

Gentlemen:

Without obligation, send details of the Murray Padlock Seal-ing system.

NAME .....
TITLE .....
COMPANY .....
ADDRESS .....

OSHKOSH

POLE LINE CONSTRUCTION TOOLS

WARNING SIGNS

Ladders	Digging Bars
Peavies	Shovels and Spoons
Cant Hooks	Pike Poles
Lug Hooks	Extra Handles
Pole Supports	Reels
Tree Trimmers and Saws	Diggers
Tamping Bars	Barricades

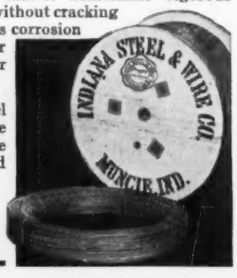
Sold and Stocked by
GRAYBAR ELECTRIC CO.
Manufactured By
LEACH COMPANY, Oshkosh, Wis.

Crapo
GALVANIZED PRODUCTS

STEEL STRAND
GUY AND MESSENGER

Telephone and Telegraph Wire

Crapo Galvanized Steel Strand is quickly, easily and economically served. Its *pure zinc* coating is so adherent and so ductile that it withstands vigorous bending and twisting without cracking or peeling. This insures corrosion resisting joints, longer years of service, lower maintenance costs.



Crapo Galvanized Steel Strand and Telephone and Telegraph Wire are available in all standard grades and sizes.

INDIANA
STEEL & WIRE CO.
MUNCIE, IND.

MERCOID
SENSATHERM
LOW VOLTAGE THERMOSTAT

EXTREMELY SENSITIVE

AN OBJECT OF BEAUTY AND MECHANICAL PERFECTION

Operates on a temperature variation of ⅓ degree above or below the point set (total differential 1°). Equipped with a mercury enclosed contact switch which is actuated by means of a permanent magnet. Not affected by dust, dirt or corrosive gases. Used wherever accurate and dependable room temperature control are required.

Write for Bulletin No. 100

THE MERCOID CORPORATION
Sole Manufacturers of The Mercoid Switch
4209 Belmont Avenue -:- Chicago, Illinois

designed for continuous operation at 500 kv. When the bridge is balanced the ratio of the secondary to the tertiary voltage is given in terms of the bridge-resistance and capacitance ratios to an accuracy of better than one part in 1,000. This ratio can be determined at any condition of loading on the transformer. Subsequently, during actual testing operations, the tertiary voltage is measured with any required degree of accuracy and the previously determined voltage ratio then gives the secondary r.m.s. voltage.

The same Schering bridge is used for dielectric loss measurements in cables tested by means of the 1,000 kva. and 1,000 kv. available from the two 500-kv., 500-kva. test transformers when they are operated in cascade.

•

Fan, Light and Cone Catch Tobacco Bugs

One of the most destructive pests which must be combated in cured tobacco warehouses is the cigarette beetle. Spending their lives in semi-darkness or diffused light, the beetles will respond to a moderately intense light, but are repelled by a very bright one. Taking advantage of this peculiarity, a suction light trap has been developed by government scientists which is being used to protect warehouses from their destructive habits.

A wire cone has in front of it a small electric motor with a two-blade fan which runs continuously while the trap is operating and a 40- or 50-watt electric light is suspended in the cone. A glass jar for collecting the beetles is kept in place by a tin elbow soldered to the neck of the cone. The trap is suspended from a warehouse ceiling where it will not interfere with the warehouse work. The light lures the beetles to the trap and the suction draws them into the container, from which they cannot escape.

Suction and light trap cigarette beetles

Upward of 200,000 beetles were caught in a jar of this size by this simple lure.

•

Power Directly From Light

So sensitive is a new photoelectric cell developed in the General Electric research laboratory that four of them convert enough energy from sunlight to operate a small motor rated at 0.0000004 hp. Enough light energy is converted into electricity when a 75-watt incandescent lamp is lighted at a distance of 8 in. from the cells so that the motor, using three ten-thousandths of an ampere of current, turns at good speed.

The photoelectric cells are of the selenium type and over the selenium is a film of platinum, so thin as to be semi-transparent. This film decidedly increases the sensitivity of the cell in its response to light. Efficiency is of such order that one watt of power can be obtained from about 20 sq.ft. of cell area in direct sunlight. The cells have about 20 per cent of their effectiveness in the ultra-violet region and the remainder in the range of visible light.

The motor, direct-connected to the cells, is of special construction, with jewel bearings and other features to reduce frictional and other losses to a minimum.

No practical applications for the sun-driven motor have been undertaken, for its rating is too low to be of immediate practical use.

MORE THAN SKIN DEEP

Glaze is a superimposed skin protection unnecessary to Pyrex insulators for they are resistant glass all the way through... Thus, no added surface is necessary for increasing cleanliness, or for increasing strength. The mechanical and electrical strength of the surface extends clear through. By complete fusion of ingredients, the entire unit is non-crystalline—resisting fatigue—non-porous.

Should the skirt of your Pyrex insulator become chipped, the life of the unit is in no way affected, for the under body when exposed has all the resistant properties of the original surface.

Not only on their surface but in their substance, Pyrex insulators give maximum protection to the line.

"PYREX" is a trade-mark and indicates manufacture by

CORNING GLASS WORKS • CORNING, N. Y.

Pyrex

POWER INSULATORS

Electrically Baked Pastry Helps Sales

One of the heavy-duty commercial cooking units installed in 1934 on the Boston Edison Company's system (the year's total aggregated 800 kw.) was purchased by the Gilchrist Company for visual service in its street floor counter restaurant at the intersection of Washington and Winter Streets, the most densely traveled intersection in the city. Despite the value of the floor space, the Gilchrist Company located the unit just inside a main entrance and in a corner readily seen from all points in the lunchroom. Baking of cakes, pies, rolls, etc., is done by an Edison Electric Appliance Company three-deck oven with nickel trim and porcelain enamel panels, operated on 220 volt direct-current service and rated at 12.8 kw. Energy is supplied at the regular "D" rate of the company giving an increment price for off-peak cooking of about 8 mills per kw.-hr., the oven being used only intermittently from 10 a.m. to 4 p.m., and not coming on the store lighting peak. Approximately 50 kw.-hr. per day is required for the service.

Electric oven installed in Boston restaurant, near the door in plain sight, to advertise fresh baked pastry

Sales of these bakery products have been stimulated by the working display in the lunchroom. Each deck of the oven is provided with independent temperature adjustment and automatic control of heating, the range of service being between 350 and 400 deg. F. for most of the work. A ventilating duct above the oven has been utilized as a means of housing cove lighting units above the operator. A fuel-burning oven was regarded as impracticable under the conditions, the advantages of electric cooking being a major attraction in the decision to purchase this kind of service.

The Edison Company suggests to prospective heavy-duty electric cooking customers that by demonstrating the use of this equipment regularly in service in busy locations the customer's sales will be increased. This selling point has been made use of in a number of recent Boston cooking installations, especially in establishments manufacturing doughnuts in or near large window spaces fronting the street, and it is also effective in selling fry kettles to roadside lunch stands, night lunch carts, etc. Other prospects are frequently taken to these installations to see how effective the operation of clean, compact equipment is even under conditions where ventilation is none too easy. As a talking point to arouse interest and press home the usefulness of commercial cooking, such a method goes far to overcome inertia and sales resistance on the part of prospects who do not readily visualize this modern equipment in use on their premises.

•

A "Little Women's Cooking Class"

On Saturday mornings from 10 to 12 a "Little Women's Cooking Class" is held in the Electric Institute in Washington, D. C. Announcement of this class was made in a newspaper advertisement and the children were registered by the mothers. Enough entrants were received to fill the first two classes from the one ad. Classes are limited to eighteen, since there are six electric kitchens available and three to a kitchen seems to work out best.

The children do the cooking themselves, as this is the only way the attention can be held. The demonstrator tells them what will be prepared, how to operate the range, what utensils to use and measures the ingredients. The first day they prepare a breakfast of bacon, eggs, biscuits and cocoa. On

Members of the "Little Women's Cooking Class" soon learn how to do it electrically—so do their mothers

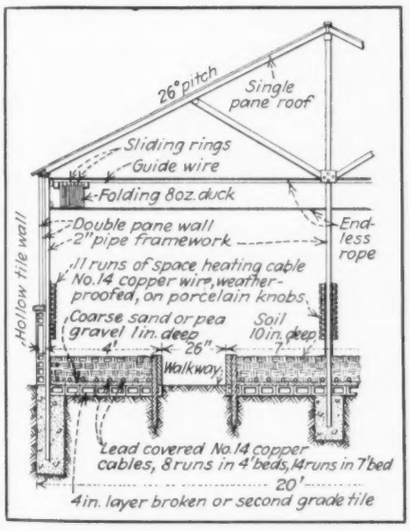
succeeding days they do a luncheon and make ice cream, spice cake and a pie, etc. While things are cooking, they become acquainted with the electric ironers and other appliances and hear the story of the science of seeing.

Children's ages have run from 8 to 14, but are being recast as one group from 11 to 15 and other groups of 16 and 17. Classes run 5 weeks. Graduating exercises are held on the last day and diplomas are given. Mothers are invited to attend. The idea is popular with both mothers and children and a good start is made in interesting both of them in the electric kitchen.

•

Greenhouses Built for Electric Heat

Where electric heat is to be used in greenhouses they should be constructed so as to conserve heat. In a paper presented to the Northwest Electric Light and Power Association,


26° pitch
Single pane roof
Sliding rings
Guide wire
Folding 8oz. duck
Double pane wall
2" pipe framework
Endless rope
11 runs of space heating cable No. 14 copper wire, weather-proofed, on porcelain knobs.
Coarse sand or pea gravel 1 in. deep
Soil 10 in. deep
4'
26"
7'
Walkway
Hollow tile wall
Lead covered No. 14 copper cables, 8 runs in 4' beds, 14 runs in 7' bed
20'
4 in. layer broken or second grade tile

Greenhouse designed to conserve electric heat

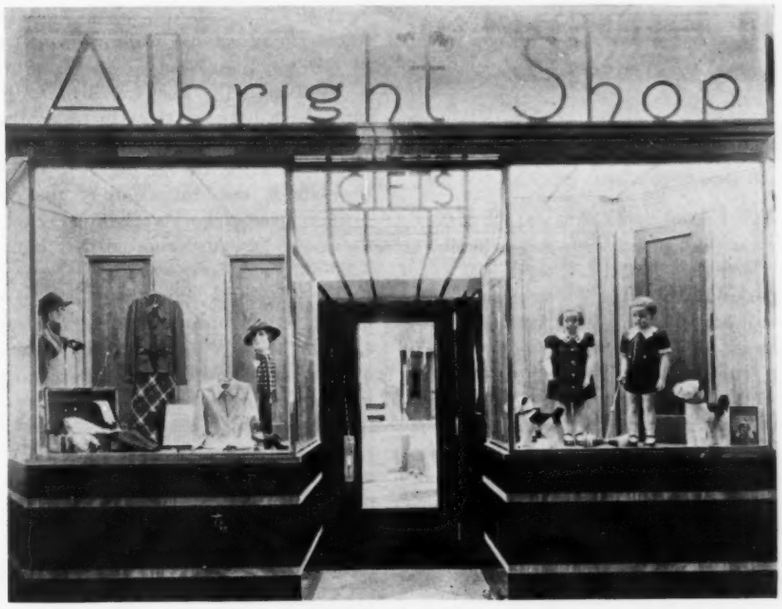
Hollow tile walls, doubled glass sides, curtain for ceiling at night and tile under the beds. Soil heated by lead-covered No. 14 B. & S. copper wire; 2,500 lineal feet required per 240-volt circuit. For space heating two 1,500-ft. lengths No. 14 B. & S. gage weather-proof wire, each section being connected to a 240-volt supply. Single-conductor, rubber-insulated, lead-covered or weatherproof copper wire in soil should not be operated at ratings exceeding 5 watts per lineal foot.

Temperature of the soil is controlled by one thermostat and a relay and each of the two space-heating circuits is controlled by a thermostat and relay. These items of control equipment will cost $53 installed and should give eight to ten years of service. One length of the lead-covered cable strung along the bottom of the wall sash and between the two panes of glass should be effective in controlling the condensation of moisture and resulting formation of green slime in the air space.

A. H. Greisser of the Portland General Electric Company said that hollow tile should be used in place of the ordinary concrete wall, double glass walls instead of single glass up to eaves, a waterproofed canvas curtain fitted with rings to permit the curtain to be drawn at night (thereby reducing the heat loss through the single-glazed roof) and second-grade or broken tile under the cultivated plots. A close estimate places the extra cost attendant to the foregoing construction at $165 for a greenhouse 20x70 ft. in ground area, against which investment annual fixed charges of $27 should be charged.

This type of construction is expected to permit a greenhouse temperature of 65 to 70 deg. F. to be maintained with a connected load of six watts per square foot of exposed glass area (14.4 kw. total connected) and an energy consumption of 0.18 watt per square foot of glass area per degree-hour, or a total energy use of 37,500 kw.-hr. for the normal weather temperatures from November to May, inclusive. The heating cable and control apparatus would cost approximately $175 installed. If the cost of the heat-insulating construction is added the total investment for electric heating would be $340, as compared with $1,600 for an oil-fired, hot-water heating system. The electric heating equipment has a further advantage over the oil-heated plant, in that additional greenhouses can be added to the operation without entailing the normal expense of revamping the fuel-fired boiler to meet the increased heating load.

Albright Shop in Buffalo



In connection with its new demonstration electric home, just installed in its downtown office building, the Buffalo General Electric Company has set up a model electric store to offer practical suggestions to the merchant. Dealers of all kinds and business men who own stores and shops are being invited to inspect this model store interior and window. They come and study the value of proper lighting and air conditioning in stimulating sales and other electrical equipment for labor saving and efficiency

Where Tradition Hampers Sales

G. E. Whitwell, vice-president in charge of sales Philadelphia Electric Company, says:

Many a utility sales department today is hampered by company sales, engineering, operating and accounting practices that have long been sound, indeed still may be, but in the interest of the present greatly enlarged load-building necessity must be modified if the best over-all good is to result.

LETTERS TO THE EDITOR

More on Ideal Distribution Transformer

To the Editor of ELECTRICAL WORLD:

I was impressed with the editorial in the November 10, 1934, issue of ELECTRICAL WORLD, page 41, entitled "Ideal Specifications for Distribution Transformers." I wonder if you would be kind enough to expand on this article, particularly along the lines of advising just what secondary disconnecting devices you had in mind. I wish to know particularly whether you refer to the secondary circuit breaker idea or transient condition protective devices. Also, just what do you refer to in the way of automatic reclosing devices; i.e., what characteristics should these have?

If you are referring to obtaining complete factory-built transformer with transient condition primary and secondary protective devices, primary and secondary disconnecting devices and automatic reclosing devices for both, it would appear that it might be necessary to deviate from simplicity and reliability.

Also, if you could elaborate on what you mean by "rather unsatisfactory" distribution transformers and give some specific idea of the class of equipment you refer to in "expensive aggregation of devices."

These questions are being asked particularly since so much thought, writing and experimenting is being placed on the distribution part of utility systems, and if you can kindly answer some of these questions it will be greatly appreciated.

C. W. KING,
Allis-Chalmers Manufacturing Co., Inc., Buffalo, N. Y.

At the present time, because of the increased sales of oil burners, refrigerators, ranges and other devices, the standards for overhead distribution as regards both voltage and service have been raised to new levels of performance. There is a general demand for revamping the distribution equipment and distribution methods of present overhead system to approach more nearly the underground service and voltage standards.

One part of this problem deals with the transformer and the editorial was discussing this in general terms as an ideal functional arrangement to meet the new standards. It had no reference particularly to any existing equipment or type of transformer. The transformer itself is thoroughly reliable and does the job of transformation adequately, and there is hesitancy in advocating any particular change in transformer design or to incorporate with the transformer winding and oil any device that has not the equivalent reliability. On the other hand, voltage transformation is just part of the functional duty of a transformer in distribution. The transformer itself must have other devices to take care of the service and voltage demands associated with its use on the system. One problem is the protection of the transformer itself from mechanical hazards, lightning hazards and thermal hazards. The next step involves the service continuity elements of a transformer connected to one circuit and serving other circuits. There should be automatic closure and reclosure and automatic protection developed to the limit to give continuous service. Development has taken place and many accessory devices are available, but much remains yet to be done to fulfill the ideal specification.

If we could make a unit assembly involving the transformer and the accessory devices we would reduce the cost of individual items, the space factor and most of the assembly on the distribution system and get more unity in the functioning of the transformer and all its corollary operations. The editorial by no means intended to assume that these devices would be put in the transformer case or outside the case, but was merely a speculative suggestion to show the trend of research and equipment to meet the fundamental changes in service and voltage standards.—[EDITORS.]

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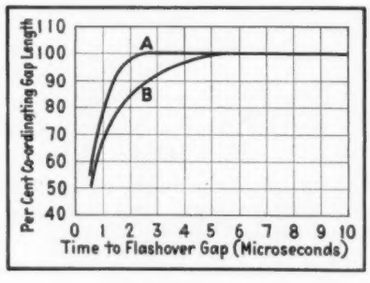
Deplores Trend in Insulation Co-ordination

To the Editor of ELECTRICAL WORLD:

I have noted with considerable concern an increasing tendency to abandon the requirement that transformer insulation be co-ordinated with the established co-ordinating gaps originally set up as a measure of transformer insulation. The recent tendency has been to use the surge tests and the test gap as proposed by the transformer subcommittee of the A.I.E.E.



Gap co-ordination for negative surges

A—Gap length in per cent of co-ordinating gap which will protect surge-proof transformers for surges of varying durations.

B—Gap length which will protect transformers just meeting A.I.E.E. transformer subcommittee tests.

as the standard of transformer insulation strength. This tendency is illustrated in the discussions at the 1934 summer convention of the A.I.E.E., by work of the joint N.E.M.A.-E.E.I. committee on insulation co-ordination and by published articles (see "Lightning Protection of Transformers," by K. B. McEachron, *G.E. Review*, August, 1934). This tendency is, of course, highly desirable, but unfortunately we know now that the test procedure recommended by the transformer subcommittee does not constitute an adequate demonstration of insulation co-ordination as intended when the recommendations were originally drafted. Why should the industry abandon insulation co-ordination with the co-ordinating gap? Would it not be better to modify the present testing recommendations so that they would constitute an adequate demonstration of insulation co-ordination?

Data in a recent paper presented to the A.I.E.E. at the winter convention shows that negative wave surges are more severe than positive wave surges when limited by the co-ordinating gap. It is logical, therefore, to consider the performance of the co-ordinating gap with negative waves in determining the extent to which insulation co-ordination may be obtained. Based on this consideration I have illustrated the extent to which insulation co-ordination can be obtained in a transformer which just meets the requirement of the present impulse testing recommendations, by curve B of the accompanying figure. It will be noted that co-ordination is obtained down to a time of approximately 5 microseconds. For shorter times it would be necessary to reduce the co-ordinating gap length in order to obtain co-ordination. At 2 microseconds a co-ordinating gap of approximately 85 per cent of the standard spacing would be required. This clearly illustrates the inadequacy of the present testing recommendations.

In connection with the A.I.E.E. paper "Recommended Transformer Standards," by H. V. Putman and J. E. Clem, December, 1934, *Electrical Engineering*, page 1595, I would suggest that the ratio of the new surge test, being considered, to the 60-cycle test be made equal to $2.2 \times \sqrt{2}$ or 3.1, since this test would constitute an adequate demonstration of insulation co-ordination with the present established gaps for traveling waves. For example, curve A illustrates the extent to which insulation co-ordination would be obtained in a transformer meeting this requirement and shows that full co-ordination is obtained down to approximately 2 microseconds, which we believe would cover requirements for traveling waves.

FRED J. VOGEL,
Division Engineer
Westinghouse Electric & Manufacturing Co., Sharon, Pa.

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MEN OF THE INDUSTRY

G. C. Estill Made President of Florida Power & Light

George C. Estill, vice-president and general manager of the Florida Power & Light Company, has been elected president and general manager of that company, succeeding Joe H. Gill, who has taken the position of chairman of

G. C. Estill

the board of the Memphis Electric Company and vice-president of the National Power & Light Company.

Going to Miami in 1924 from New Orleans, Mr. Estill has been associated with the Florida Power & Light Company for the past ten years, from 1925 to March, 1934, as general superintendent and from last March until the present as vice-president and general manager.

Born and raised on a Blue Grass farm near Lexington, Ky., Mr. Estill was graduated from Kentucky University with the degree of bachelor of arts, and later from Cornell University with a master of engineering degree. He has been employed in the utility field during his entire professional career, in Nashville, Birmingham, Portland, Montgomery and New Orleans, then Miami. Mr. Estill has been prominently identified with civic activities from the time he made his residence in Miami. He was recently elected vice-president at large of the Florida State Chamber of Commerce.

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► J. Lee Potter has been elected president of the Arthur W. Wood Company, Boston, Mass., a well-known investment banking house identified with public utility security marketing. Mr. Potter has had a wide experience in operating practice. For fifteen years he was connected with the Western Massachusetts Companies' group of utilities in the Connecticut Valley, working upward from the power station and commercial departments to the superintendency of the Amherst Gas Company. From 1918 to 1925 he was manager of the Newburyport (Mass.) Gas & Electric Company. For the past nine years he has been connected with the Wood organization.

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Underwriters' Laboratories Names A. R. Small President

A. R. Small, who has been connected with the Underwriters' Laboratories, Chicago, since 1906, was elected president of that organization at a special meeting of the board of directors held in Chicago January 7. He is succeeding the late Dana Pierce. Mr. Small became vice-president in 1916 and was transferred to New York in 1924 as resident vice-president. Soon after becoming established in New York City, Mr. Small was appointed chairman of the electrical committee of the National Fire Protection Association, which has charge of the biennial revisions of the National Electrical Code. During his term as chairman the committee was reorganized so as to function as a sectional committee of the American Standards Association. Mr. Small will continue as chairman of this committee, at least until the work now in progress on the 1935 revision is completed.

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► A. C. Spurr recently entered upon the duties of president of the Monongahela West Penn Public Service Company, Fairmont, W. Va. (Electrical World, January 5, page 108). Mr. Spurr had been

A. C. Spurr

prominently identified with the transportation industry for a number of years. Prior to his recent appointment he had been assistant to the president of the West Penn System.

G. G. Gale Elected Head of Canadian Utilities

G. Gordon Gale, formerly vice-president and general manager of the Gatineau Power Company, has been made president of that company and also of the Canadian Hydro-Electric Corporation. He succeeds A. R. Grau-

G. G. Gale

stein of New York, who remains on the boards of the two companies.

One of the best known electrical engineers in eastern Canada, Mr. Gale gained his first experience as an engineer with the Caledonia Mine, Dominion Coal Company, where he was for some years assistant underground manager. After connections with the Consolidated Rubber Company and with Ross & Holgate, consulting engineers of Montreal, he joined the Hull Electric Company as superintendent, subsequently becoming vice-president and general manager. Upon the formation of the Gatineau Power Company Mr. Gale was placed in charge of certain power developments, in 1926 was named general manager, and in less than a year vice-president.

At present Mr. Gale is vice-president of the Gatineau Electric Light Company, Ltd., the Gatineau Transmission Company, the Saint John River Power Company and president of the Hull Electric Company and the Maniwaki Power & Telephone Company. He is also a director of the International Hydro-Electric System and the Canadian International Paper Company.

He holds membership in the Engineering Institute of Canada, Canadian Electrical Association, Professional Engineers of Quebec and the Canadian National Committee of the International Electrotechnical Commission. He is a past-president of the Canadian Electric Railway Association.

E. A. Edkins Retires

Ernest A. Edkins, known as the man who opened the first shop devoted to electric appliance sales, has just retired from active service after spending 41 years with the Commonwealth Edison Company. Starting as a reporter on

E. A. Edkins

the New York *Evening Sun* at the age of eighteen, Mr. Edkins continued in newspaper work in the Middle West until 1893, when he joined the staff of the Chicago Edison Company, predecessor of the Commonwealth Edison Company. In the course of his career he served as superintendent of the company's welfare and employment bureau and as secretary of the advisory committee. For several years he edited the "Round Table," issued by the Commonwealth Edison Company section of the National Electric Light Association, and in 1911 and 1912 he compiled the "Question Box" for the association in which he was extremely active.

It was in 1909 that, at the suggestion of John F. Gilchrist, Mr. Edkins opened the electric shop for the company at the corner of Jackson Boulevard and Michigan Avenue. He remained to see numerous branches established and his original shop grow to the length of a city block.

Gardner S. Howland succeeds to the title of general manager of the Commonwealth Edison Company's electric shops. Mr. Howland has been identified with the company since 1917.

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▶ J. A. Peacock has been placed in charge of the Atlanta, Ga., sales office recently opened by the General Cable Corporation.

▶ Hugh Drake, a member of the Nebraska State Railway Commission, has been elected chairman of that body.

▶ Col. C. H. Crawford of New York has been selected by the American Engineering Council to direct its efforts in developing opportunities for the employment of engineers in the government service on behalf of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, the American Society of Civil Engineers and the American Institute of Mining and Metallurgical Engineers.

▶ Allan O. Summerville, assistant superintendent and electrical engineer of the distribution department Malden (Mass.) Electric Company, a New England Power Association subsidiary, has been appointed superintendent of production. Kenneth Proctor, formerly assistant electrical engineer, will take over Mr. Summerville's previous duties.

▶ G. M. Alexander, who retired on January 1 as head of the Monongahela-West Penn Public Service Company, Fairmont, W. Va., after 30 years' service, was presented with a testimonial booklet containing the signatures of more than 1,300 employees of the company at a luncheon held in the Fairmont Hotel on January 5. J. H. Buchanan, vice-president, made the presentation. Captain Alexander became attorney for the Monongahela Valley Traction Company in 1910 and when that company was succeeded by the Monongahela System in 1919 he was named president. One of the most prominent business executives in the state, he has been affiliated with numerous industrial enterprises.

OBITUARY

A. S. Grenier

Arthur S. Grenier, a vice-president of the Electric Bond & Share Company and an officer and director in several affiliated companies, died, after a short illness, January 13 at his home in Upper Montclair, N. J. Mr. Grenier, who was born at Martinton, Ill., had gained extensive public utility experience in Iowa, Illinois and the Pacific Northwest before joining the Electric Bond & Share Company's staff in 1912. In this earlier period he is credited with designing and constructing the first high-voltage transmission line built in Illinois.

Mr. Grenier was a vice-president of the American Power & Light Company, Electric Power & Light Corporation and Florida Power & Light Company and vice-president and a director of the Texas Power & Light, Texas Electric Service, Central Arizona Light & Power, Houston Lighting & Power and Dallas Power & Light companies.

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▶ Charles M. Marsh, head of the commercial engineering department of the Potomac Electric Power Company, Washington, D. C., died suddenly, January 1, at his home in Chevy Chase, Md. Following graduation from Cornell University in 1904, Mr. Marsh obtained his early engineering training with the General Electric Company at Schenectady and with the New York Transportation Company. It was in 1909 that he became head of the Potomac Electric Power Company's commercial engineering department.

▶ Herbert B. Rust, for many years identified with the development and operation of electric light and power companies in central New Hampshire and long head of the Utilities Power Company of Meredith prior to its acquisition by the Public Service Company of New Hampshire system, died at his winter home in Miami, Fla., November 29.

▶ Frank W. Wicks of Wellesley Hills, Mass., formerly New England sales manager of the Westinghouse Lamp Company, with offices in Boston, died November 19 in Fort Union, Va., of a paralytic stroke. In 1909 Mr. Wicks joined the Westinghouse Lamp Company. Assuming gradually broader responsibilities, in 1924 Mr. Wicks became assistant to the general sales manager for the whole company with offices in New York. He was assigned to his New England position in 1927.

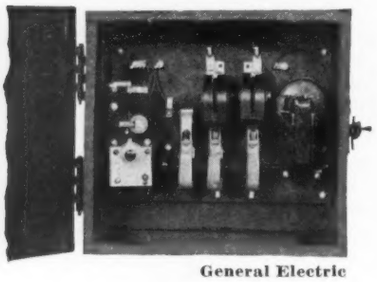
▶ B. E. Forbes, chief engineer for the Nebraska State Railway Commission since 1914, died at his home in Lincoln January 5, after an illness of three months. A graduate of the University of Nebraska, Mr. Forbes had been assistant state engineer, in the government reclamation service and in private practice before joining the staff of the state commission. He was an outstanding authority on valuation methods and his services had proved to be invaluable to the commission over a period of years when rate cases were many.

▶ George A. Hamilton, a retired consulting engineer of the Western Electric Company of New York and an honorary and charter member of the American Institute of Electrical Engineers, died January 10 at his residence in Elizabeth, N. J. Born in Cleveland 91 years ago, Mr. Hamilton became interested in telegraphy at an early age. After eight years of practical experience, he became assistant to Prof. Moses G. Farmer of Boston, with whom he participated in many important experiments and investigations in the field of telegraphy. Later, with Garritt Smith, he built the first quadruplex telegraph circuit to be operated in this country. After introducing the system abroad, he returned to this country and took charge of fine electrical instruments for the Western Electric Company, a position which he held until his retirement in 1909. In addition to holding honorary membership in the American Institute of Electrical Engineers, Mr. Hamilton was a member of the British Institution of Electrical Engineers and La Société Française des Electriciens.

NEW EQUIPMENT

Automatic Timer for Spot and Projection Welders

Synchronous motor-operated timer, type CR7993, for automatically timing the power supply to resistance welders by controlling the contactor on the



General Electric

welder has been announced by the General Electric Company. Once set, the timer is unaffected by line-voltage variations or surges, it is claimed. When adjusted for welding two thicknesses of metal the control will provide satisfactory welds when several thicknesses of metal are placed between the electrodes, no change in timer or welder setting being required.

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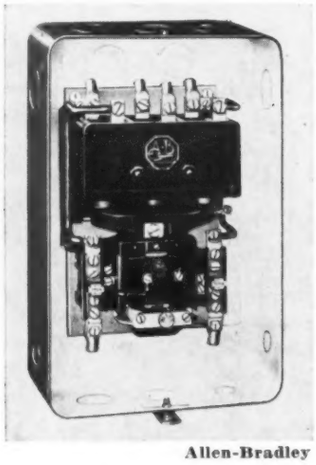
Solenoid-Operated Starting Switches

The line of solenoid-operated starting switches manufactured by the Allen-Bradley Company, Milwaukee, Wis., has been extended from its previous limit of



Allen-Bradley

25 amp. to include 50 and 100-amp. ratings. The two new switches will handle polyphase motors up to 15 hp., 110 volts; 30 hp., 220 volts, and 50 hp., 440-550 volts. They can also be used for starting single-phase motors across the line. These switches occupy much less space than the clapper switches they replace and leave generous wiring space in all cabinets. They are self-insulated. Each switch unit is mounted upon a metal back plate which can be attached to machine bases or metal cabinets without further insulation. The interiors are white enameled, thus reflecting light into the working parts and making the terminals, switching mechanism and relays easily seen.

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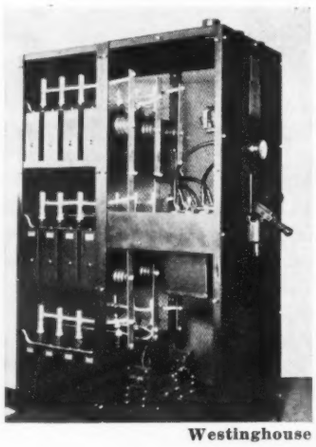
Hermetically Sealed Power Capacitors

A line of hermetically sealed power capacitors about one-half the size and one-third the weight of conventional oil-



Westinghouse

filled units is announced by Westinghouse Electric & Manufacturing Company. The individual units are impregnated with the Westinghouse fireproof impregnating medium "inerteen," are housed in welded cases of 0.05 sheet steel and equipped with rugged solder seal porcelain terminal bushings. Because of their compact, light weight and leakproof design, these capacitors expand the economical use of power-factor correction in many industrial plants.

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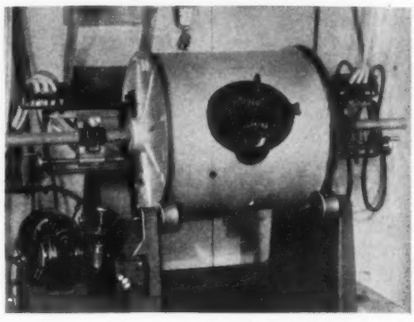
A METER to indicate and record both boiler water level and feedwater flow has been announced by the Bailey Meter Company, Cleveland, Ohio, for use in boiler plants where it is desired to have an indication, integration and record of these factors on the operating floor.

Melting Furnace With Automatic Rocking Device

An electric melting furnace with automatic rocking device, designated type GM, has been announced by the Detroit Electric Furnace Company, Detroit, Mich. It



Detroit Electric Furnace

increases the angle of rock of the furnace shell automatically. One rate of increase is available for ferrous and another rate for non-ferrous materials. The unit is rated as 35 lb. cold charge and 80 lb. molten capacity, suitable for laboratory use.

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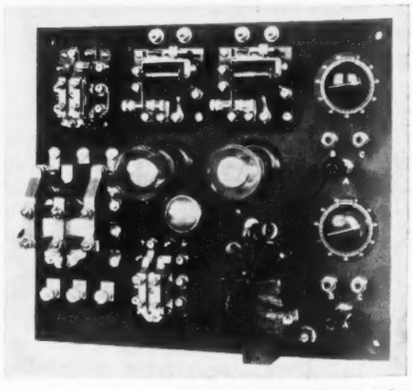
Automatic Repeat Process Timer

For use in connection with a wide variety of electrically operated devices and machines requiring automatic timing of the power-on, power-off periods, the Electric Controller & Manufactur-



Electric Controller & Mfg.

ing Company, Cleveland, Ohio, has announced an EC&M automatic repeat process timer. It is built in four standard sizes and is designed for operation on 110, 220, 440 or 550-volt circuits of any standard frequency. Operating on the principle of the time re-

Business Men's PROSPERITY SURVEY

HERE'S a chance to give voice to your own ideas as to which national policies you believe most likely to speed recovery in your line of business.

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BUSINESS men, nationally, may appreciate an opportunity to express their convictions to a strictly non-partisan and impartial body—with the assurance that by so doing, business views will be presented effectively to the political, banking, industrial, business and labor leaders of the country.

QUESTIONS on the economic ballot below are prefaced with "In your line of business" to make possible an industry by industry study as well as a consensus of business opinion in all fields of industry—so let our industry be well represented in the responses.

ECONOMIC BALLOT

Check your convictions, sign, clip and mail this ballot.

1. As regards the possibility of Congress adopting a universal thirty-hour work week, do you favor such legislation? Yes ( ) No ( ); and if so on the basis of ( ) continuation of existing weekly wages, or ( ) continuation of existing hourly rates of pay.
2. In your line of business are you satisfied with enforcement of maximum hours and minimum wage provisions now in effect? Yes ( ) No ( )
3. In your line of business is there obtainable ample working capital—from banks? Yes ( ) No ( ); from government agencies? Yes ( ) No ( )
4. In your line of business is there obtainable ample investment capital—from banks? Yes ( ) No ( ); from government agencies? Yes ( ) No ( )
5. In your line of business do you favor limitation of industrial output—by government control? Yes ( ) No ( ); by industry control? Yes ( ) No ( )
6. In your line of business do you favor a plan for control of prices—by a code provision establishing price fixing? Yes ( ) No ( ); by a code provision establishing an open price plan? Yes ( ) No ( )
7. In your line of business do you think that government measures now in effect are helping small and medium sized enterprises? Yes ( ) No ( ); hurting such enterprises? Yes ( ) No ( )

Sign or not as you please .....

Kind of Business .....

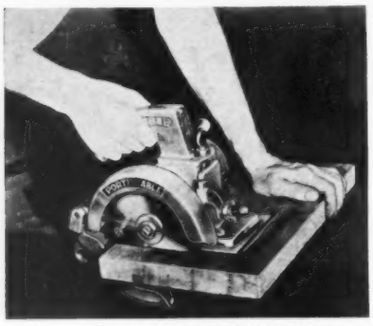
Please return this ballot to: Electrical World c/o The Associated Business Papers, Inc. 330 West 42nd St., New York, N. Y.

quired to charge a condenser, it provides a quick, convenient means for closing an electrical circuit for a definite length of time, and then opening the circuit for a similar, or different time, as desired, and repeating this cycle of operation as long as the control push button or master is closed. Both the power-on and the power-off periods are independently adjustable to give the time desired.

•

"Speedmatic" Saw

Porter-Cable Machine Company, Syracuse, N. Y., announces a "Speedmatic" type K-66 6-in. saw with a cutting capacity of $1\frac{7}{8}$ in. Some of the features are: Light weight (12 lb.); finger tip depth and angle adjustment; takes standard 6-in. blade, dado cutters, abrasive disks, etc., with round $\frac{1}{2}$-in. diameter holes; special universal motor,



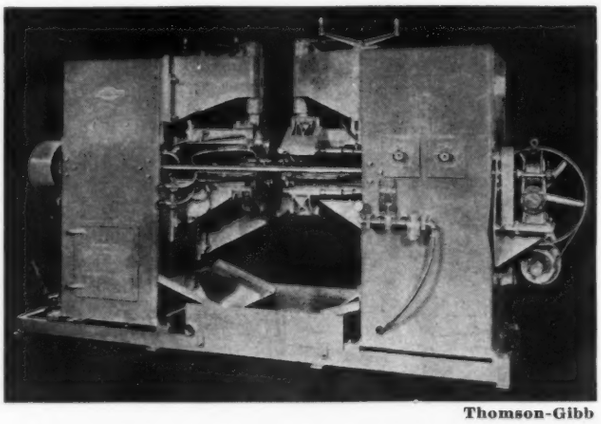
Porter-Cable Machine

developing $\frac{1}{3}$ hp. at idle speed of 5,000 r.p.m.; cutting speed, 4,000 r.p.m., etc. With proper abrasive wheels, stone, marble, slate and composite materials may be cut.

•

Electric Seam Welder Assembles Shock Absorbers

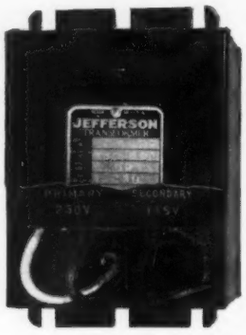
Duplex seam welder that joins a forging to each end of a tubular shock absorber housing has been developed by the Thomson-Gibb Electric Welding Company, Lynn, Mass. It welds both ends at the same time and each of the two units that make up the complete welder makes two welds in series. Actually, the machine makes four seam welds simultaneously so that the housing is rotated only one-half revolution to complete the work. Both units of the machine are operated by a single variable speed motor and are powered by 100-kva. transformers.



Thomson-Gibb

Transformers With Inclosed Connections

Lighting transformers designed in complete inclosing case with separate compartments for primary and secondary



Jefferson Electric

leads have been announced by the Jefferson Electric Company, Belwood, Ill. Knockout holes are provided for entrance of flexible or rigid conduit or, by use of porcelain bushing, open wiring may be brought in.

These transformers supply 110-120-volt current to lamps and various small motor-driven tools and heating appliances. Their use puts this sort of load on the lower rate power circuits and in many cases saves expense in wiring installation. They are built to Underwriters' specifications and in various ratings and capacities up to 20,000 volt-amperes.

•

Switch Control Panel for Electric Ranges

Two-heat switch control panel for operating hot plates and oven elements has been announced by the Hart Manufacturing Company, Hartford, Conn. It consists of four or five toggle switches mounted in one bakelite block, ready to mount as a unit on the electric range. Simple balancing of the elements is made possible through the unique bus arrangement which is a permanent part of the switch panel. Many wiring combinations are available to obtain the desired cooking heats. The switch is approved by the Underwriters' Laboratories for use on alternating current.

ENGINEERING DATA FROM MANUFACTURERS

Bulletins and catalogs now available to engineers by manufacturers and associations

A four-page bulletin describes the new Ferranti, Inc. (130 West 42d Street, New York, N. Y.), "Clip-On" ammeter with its wide range of full scales and variety of frames with openings to take busbars up to $4\frac{1}{2}$ x $3\frac{1}{2}$ in., pointing out 23 of its features.

Description of fabrication processes and control along with complete specifications of all Ohio Brass Company (Mansfield, Ohio) electrical products are in new 422-page catalogue 21. Many typical installations are inserted. Standards of A.I.E.E. for insulator tests and other engineering data are included. New heavy shock-resistant insulators and strain fittings appear. The thumb-index is new and convenient.

Federal Specifications Board, Washington, has circulated proposed revision (W-S-871) of specifications for federal purchase of switches; open type, front- and rear-connected. Comments are desired.

Construction details of Ingersoll-Rand (New York) Diesels and tables of available ratings and dimensions are contained in new publication "The Diesel Engine. Stationary Type."

Data on calculation of floodlighting, show-window lighting and on use of zone curves of sources are included in new 106-page General Electric Supply Corporation (Bridgeport, Conn.) catalogue "Lighting."

Kliegl Brothers Universal Electric Stage Lighting Company (New York) has issued 16-page bulletin 106 of lighting equipment for movie studios and commercial photography. Controls and application covered.

"Standards on Electrical Insulating Materials" is a recent A.S.T.M. (260 S. Broad St., Philadelphia) 284-page publication covering specifications and test methods.

Construction details and ratings of "Indestructo Rubber Sheathed Cables" for industrial use are in National Electric Products Corporation (Pittsburgh) folder.

Operation, application, and typical installations of Kirk interlock systems for power stations and industrial applications are in a new 22-page bulletin (No. 1349) that has been issued by the Railway & Industrial Engineering Company, Greensburg, Pa.

PRODUCT INDEX

AIR COMPRESSORS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

AIR-CONDITIONING EQUIPMENT
Frigidaire Corp., Dayton, Ohio.
General Electric Co., Schenectady, N. Y.
Kelvinator Corp., Detroit, Mich.
Westinghouse E. & M. Co., E. Pittsburgh, Pa.

AMMETER, CLIP-ON
Columbia Elec. Mfg. Co., Cleveland, Ohio
Ferranti, Inc., New York, N. Y.

ANALYSES, REVENUE
Recording & Statistical Corp., New York, N. Y.

ANCHORS, GUY
Chance Company, Centralia, Mo.
Everstick Anchor Co., Fairfield, Iowa.
Hubbard & Co., Pittsburgh, Pa.
Kearney Corp., James R., St. Louis, Mo.
Line Material Co., South Milwaukee, Wis.

APPLIANCES, HEATING
General Electric Co., Schenectady, N. Y.
Graybar Electric Co., New York, N. Y.

BATTERIES, STORAGE, ALL APPLICATIONS
Electric Storage Battery Co., Phila., Pa.
Gould Storage Battery Co., Depew, N. Y.

BATTERIES, STORAGE, AUTOMOTIVE
Firestone Tire & Rubber Co. Akron, Ohio.

BATTERY CHARGING APPARATUS
General Electric Co., Schenectady, N. Y.

BEARINGS, ROLLER
Timken Roller Bearing Co., Canton, Ohio.

BLOCKS, LINEMEN'S CABLE STRINGING
Western Block Co., Lockport, N. Y.

BLOCKS, METER TEST
States Company, Hartford, Conn.

BOILERS, STEAM
Babcock & Wilcox Co., New York, N. Y.
Combustion Engineering Co., New York, N. Y.

BOXES, FUSE
G & W Elec. Specialty Co., Chicago, Ill.
General Electric Co., Bridgeport, Conn.

BRACES & STRAIN INSULATORS, WOOD
Hubbard & Co., Pittsburgh, Pa.

BRACKETS & WIREHOLDERS, INSULATED
Hubbard & Co., Pittsburgh, Pa.

BRUSHES, CARBON
National Carbon Co., Cleveland, O.

BURNERS, OIL, GAS, PULVERIZED FUEL
Babcock & Wilcox Co., New York, N. Y.
Combustion Engineering Co., New York, N. Y.

BUS BAR SUPPORTS
Burndy Engineering Co., New York, N. Y.
General Electric Co., Schenectady, N. Y.
Pacific Elec. Mfg. Corp., San Francisco, Cal.
Schweitzer & Conrad, Inc., Chicago, Ill.

BUS BARS & TUBES
American Brass Co., Waterbury, Conn.

CABLE, ELECTRIC
American Elec'l Works, Phillipsdale, R. I.
American Steel & Wire Co., Chicago, Ill.
Anaconda Wire & Cable Co., New York, N. Y.
Crescent Ins. Wire & Cable Co., Trenton, N. J.
General Cable Corp., New York, N. Y.
General Electric Co., Schenectady, N. Y.
Kerite Ins. Wire & Cable Co., New York, N. Y.
Okonite Co., Passaic, N. J.
Okonite-Callender Cable Co., Passaic, N. J.
Rockbestos Products Corp., New Haven, Conn.
Roebling's Sons Co., J. A., Trenton, N. J.
Simplex Wire & Cable Co., Boston, Mass.
United States Rubber Co., New York, N. Y.

CABLE, STEEL STRAND
American Steel & Wire Co., Chicago, Ill.
Indiana Steel & Wire Co., Muncie, Ind.
Roebling's Sons Co., J. A., Trenton, N. J.

CABLE ACCESSORIES
G & W Elec. Specialty Co., Chicago, Ill.
General Cable Corp., New York, N. Y.
General Electric Co., Schenectady, N. Y.
Line Material Co., South Milwaukee, Wis.
Metropolitan Device Corp., Brooklyn, N. Y.

CABLE END BELLS
G & W Elec. Specialty Co., Chicago, Ill.

CABLE FIREPROOFING
Johns-Manville Corp., New York, N. Y.

CAPACITORS
General Electric Co., Schenectady, N. Y.
Westinghouse E. & M. Co., E. Pittsburgh, Pa.

CHOKE COILS
American Transformer Co., Newark, N. J.
General Electric Co., Schenectady, N. Y.

CIRCUIT BREAKERS, CARBON
I-T-E Circuit Breaker Co., Philadelphia, Pa.

CIRCUIT BREAKERS, OIL AND AIR
Condit Electrical Mfg. Corp., Boston, Mass.
General Electric Co., Schenectady, N. Y.
Pacific Elec. Mfg. Corp., San Francisco, Cal.
Westinghouse E. & M. Co., E. Pittsburgh, Pa.

CIRCUIT BREAKERS, THERMAL
I-T-E Circuit Breaker Co., Philadelphia, Pa.

CLAMPS, CABLE
Brewer-Titchener Corp., Cortland, N. Y.

CLAMPS, GUY
Hubbard & Co., Pittsburgh, Pa.
Kearney Corp., James R., St. Louis, Mo.

CLAMPS, TAP-OFF
Tips Tool Co., Taylorville, Ill.

CLIPS, GROUND WIRE
Kearney Corp., James R., St. Louis, Mo.

CLUTCHES, MAGNETIC
Cutler-Hammer, Inc., Milwaukee, Wis.

COMMUNICATION EQUIPMENT
Western Electric Co., New York, N. Y.

COMMUTATOR RESURFACERS
Ideal Commutator Dresser Co., Sycamore, Ill.

CONDENSERS, STATIC
Acme Wire Co., New Haven, Conn.

CONDENSERS, STEAM
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Westinghouse E. & M. Co., E. Pittsburgh, Pa.

CONDENSER TUBES
American Brass Co., Waterbury, Conn.

CONDUIT, ASBESTOS-CEMENT
Johns-Manville Corp., New York, N. Y.

CONDUIT, FIBRE
Fibre Conduit Co., Orangeburg, N. Y.
General Electric Co., Bridgeport, Conn.
Graybar Electric Co., New York, N. Y.
Line Material Co., South Milwaukee, Wis.

CONDUIT, METALLIC
American Brass Co., Waterbury, Conn.
General Electric Co., Bridgeport, Conn.
Graybar Electric Co., New York, N. Y.

CONDUIT STRAPS
Kearney Corp., James R., St. Louis, Mo.

CONNECTORS, SOLDERLESS
Burndy Engineering Co., New York, N. Y.
Electroline Company, Chicago, Ill.
Fargo Mfg. Co., Poughkeepsie, N. Y.
General Electric Co., Schenectady, N. Y.
Kearney Corp., James R., St. Louis, Mo.
Line Material Co., South Milwaukee, Wis.
Railway & Industrial Engrg. Co., Greensburg, Pa.
Reliable Electric Co., Chicago, Ill.
Sherman Mfg. Co., H. B., Battle Creek, Mich.

CONNECTORS, TINNED COPPER
National Telephone Supply Co., Cleveland, O.

CONSTRUCTION SERVICE
Hoosier Engrg. Co., Chicago, Ill.
Stone & Webster Engrg. Corp., Boston, Mass.

CONTROL, MOTOR
Allen-Bradley Co., Milwaukee, Wis.
Condit Elecl. Mfg. Corp., Boston, Mass.
Cutler-Hammer, Inc., Milwaukee, Wis.
Electric Controller & Mfg. Co., Cleveland, O.
General Electric Co., Schenectady, N. Y.
Lincoln Electric Co., Cleveland, O.
Square D Co., Milwaukee, Wis.
Westinghouse E. & M. Co., E. Pittsburgh, Pa.

CONTROLS, AUTOMATIC
Mercoid Corp., Chicago, Ill.
Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

COOKING EQUIPMENT, COMMERCIAL
Edison G. E. Appliance Co., Chicago, Ill.

CORDS, HEATER
American Steel & Wire Co., Chicago, Ill.
Driver-Harris Co., Harrison, N. J.
General Cable Corp., New York, N. Y.
General Electric Co., Bridgeport, Conn.
Okonite Company, Passaic, N. J.
Rockbestos Products Corp., New Haven, Conn.
United States Rubber Co., New York, N. Y.

CROSSARMS
Graybar Electric Co., New York, N. Y.

CUBICLES
Condit Elecl. Mfg. Corp., Boston, Mass.

CUTOUTS
Condit Elec'l Mfg. Corp., Boston, Mass.
G & W Elec. Specialty Co., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Kearney Corp., James R., St. Louis, Mo.
Line Material Co., South Milwaukee, Wis.
Railway & Industrial Engrg. Co., Greensburg, Pa.
Schweitzer & Conrad, Inc., Chicago, Ill.

DETECTORS, VOLTAGE
Schweitzer & Conrad, Inc., Chicago, Ill.

DISCONNECT PLUGS
Metropolitan Device Corp., Brooklyn, N. Y.

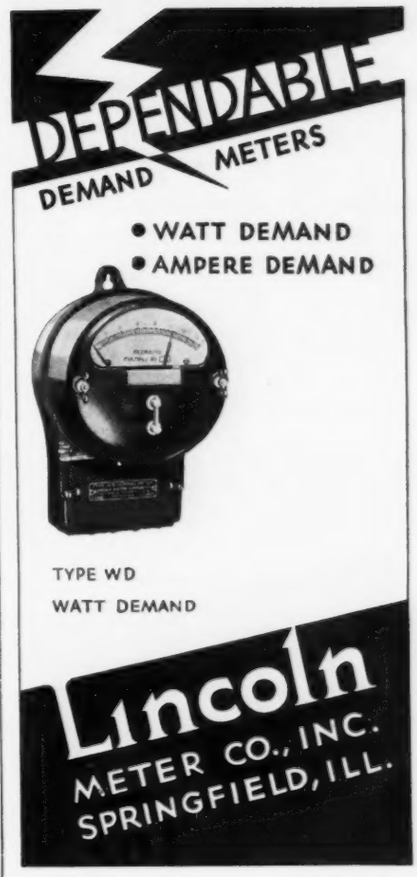
DRAFTING ROOM EQUIPMENT & MATERIALS
Bruning Co., Charles, New York, N. Y.

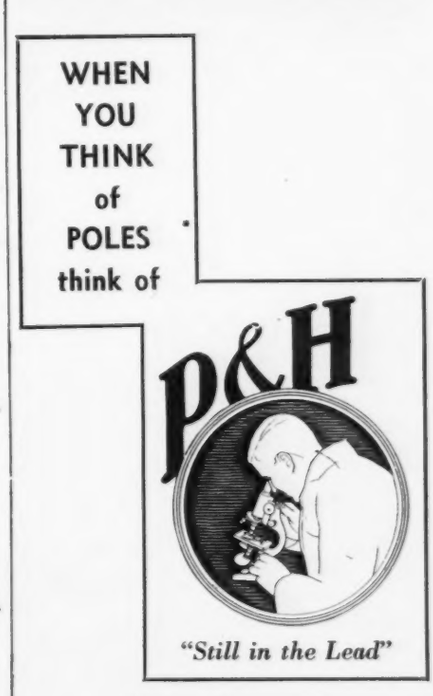
ECONOMIZERS, FUEL
Babcock & Wilcox Co., New York, N. Y.
Combustion Engineering Co., New York, N. Y.
Superheater Co., New York, N. Y.

ELEMENTS, HEATING
General Electric Co., Schenectady, N. Y.
Wiegand Co., Edwin L., Pittsburgh, Pa.

ENAMELS
Sherwin-Williams Co., Cleveland, Ohio.

ENCLOSURES FOR ELECTRICAL PURPOSES
Superior Switchbd. & Devices Co., Canton, O.





Recent Rate Changes

Minneapolis General Electric Company has announced a new residential electric rate which will save users $350,000 annually. The new rate, effective on bills rendered on and after February 1, eliminates and replaces both the standard and optional rates now in use and is calculated to encourage complete electrification of the home. Under the new schedule there is a fixed charge of 10 cents per room per month plus the following energy charges: First 6 kw.-hr. per room per month 5 cents per kilowatt-hour; next 50 kw.-hr., 3 cents; next 50 kw.-hr., 2.5 cents; next 200 kw.-hr., 2.0 cents, and anything in excess 1.5 cents. The schedule contains a special water heating rate of 1.0 cent net per kilowatt-hour for off-peak controlled service.

•

Mississippi Power & Light Company has obtained an order from Federal Judge Edwin R. Holmes restraining officials of Jackson City from enforcing for 30 days the city-ordered electric rate reduction scheduled to go into effect January 4. Judge Holmes issued this order pending a decision as to his jurisdiction in the injunction suit brought by the utility company against the city.

•

Virginia Electric & Power Company's new home service rate is now applicable to those who use energy for electric lighting only, as well as to users of electric refrigerators, ranges and water heaters. Approximately 67,000 resident customers on January 1 received the benefit of this reduced power rate, hitherto available only to users of appliances. No estimate has been made, according to J. G. Holtzclaw, president of the company, of the saving to consumers, inasmuch as it depends upon the amount of electricity consumed. In North Carolina, where Virginia Electric & Power also has properties, Stanley Winborne, chairman of the state Corporation Commission, announced that the reduction in the company's rates in that state would amount to "at least $50,000 annually."

•

Northern Indiana Public Service Company, Traction Light & Power Company and Northern Indiana Power Company have proposed electric rate reductions, amounting to approximately 10 per cent, for 457 cities and towns in Indiana in petitions filed recently with the state Public Service Commission. The companies, which have approximately 129,495 customers, are among the operating units of the Midland United group.

•

Virginia Public Service Company has announced that the second step of the $77,000 rate reduction to residential lighting consumers announced last September will become effective for service rendered in January and reflected in meter readings made on and after February 1. Further reductions are scheduled for April and September.

•

Georgia Power Company's residential power consumers had their "base bills" reduced approximately 5 per cent on January 1 when they were placed on the "inducement rate" schedule of the company by an order of the Georgia Public Service Commission. The "inducement" rate permits customers who have increased their consumption of power in any one month over that used for the same month of the previous year to receive a certain number of kilowatt-hours free of charge. It is estimated that the change in rates will reduce the annual income of the company somewhere between $60,000 and $70,000 a year.

•

Potomac Edison Company has been ordered by the Public Service Commission of Maryland to make a reduction of $325,000 in electric rates, effective in February. The commission, in ordering the cut, allowed the company a return of 6½ per cent on a valuation of the electric division of $13,839,174, for the year ending June 30, 1935.

SALES OPPORTUNITIES IN NEW CONSTRUCTION

Spot coverage of new work. Projects approved and proposed, bids requested, equipment wanted, funds available. Prospects for the electrical manufacturer.

ANDERSON, IND.—Greer Steel Company, Dover, Ohio, plans installation of heavy-duty motors and controls, regulators, conveyors, electric hoists and other equipment in new cold-rolled strip-steel mill at Anderson, where tract of 36 acres of land has just been purchased. Cost about $500,000.

FORT WORTH, TEX. — Is arranging financing in amount of $2,225,000, fund to be used for new city-owned electric light and power plant, including transmission and distribution lines.

DENVER, COLO. — Bureau of Reclamation asks bids for equipment for Boulder power plant, Boulder Dam Project, California-Nevada-Arizona, as follows: Until January 24, for five 30-in. diameter sphere valves for connection to station service penstock (Specification 610); until January 28, for three oil purifiers, each with capacity of 1,200 gal. per house (Specification 647-D), for 12 bulkhead gates for turbine draft tubes, 15 ft. 2 in. by 14 ft., with lifting hooks, rollers, seals, storage brackets, etc., and for two similar bulkhead gates for like service, 11 ft. 4 in. by 14 ft., and 17 ft. 10 in. by 14 ft., respectively, with same accessory equipment (Specification 648-D).

SUTHERLAND, NEB. — Platte Valley Public Power & Irrigation District, Donald D. Price, North Platte, Neb., chief engineer and business manager, asks bids until January 24 for construction of 6-mile, 13,200-volt transmission line, and for field telephone lines. Parsons, Clapp, Brinckerhoff & Douglas, New York, N. Y., are consulting engineers.

KNOXVILLE, TENN.—Has let contract to Hess & Barton, Pittsburgh, Pa., for construction of first section of city-owned power distribution system, covering Northeastern district (about one-fourth of entire system to be built) at $197,575. Bids for other sections will be asked soon. Power will be furnished by T.V.A.

ELWOOOD, IND.—Continental Can Company, Inc., New York, N. Y., plans installation of motors and controls, conveyors, regulators, hoists and other equipment in new multi-unit plant at Elwood, where site is being purchased. Cost over $400,000.

YELLOWSTONE PARK, WYO.—United States National Park Service, Washington, D. C., soon takes bids for extensions and improvements in hydro-electric generating plants on Panther and Indian Creeks, Yellowstone Park, including installation of new equipment. Appropriation of $237,000 has been authorized. Roger Toll, Mammoth Hot Springs, Yellowstone Park, is superintendent in charge of plants.

HAVRE DE GRACE, MD. — Harford Pure Rye Distillers, Inc., Baltimore, Md., plans new multi-unit plant at Havre de Grace, including power house. Cost over $100,000.

PINE BLUFF, ARK.—Arkansas Power & Light Company plans new transmission lines, power substations and distributing systems in rural districts in about 55 counties of state, totaling close to 3,500 miles in all, for electric light and power service in present isolated areas. Cost close to $5,000,000. Work will be started early in 1935.

WALLA WALLA, WASH. — Libby, McNeill & Libby, Chicago, Ill., plan installation of motors and controls, conveyors, loaders and other equipment in new food products canning plant at Walla Walla, including power house. Cost close to $200,000.

TRENTON, MICH.—Trenton Valley Distillers Corporation plans two new one and multi-story additions to plant. Cost close to $100,000, with equipment. George F. Diehl, 120 Madison Avenue, Detroit, Mich., is architect.

ZANESVILLE, OHIO — United States Engineer Office asks bids until January 31 for construction of Clendening Dam, including power house, electric lighting system, conduits for electrical wiring, crane, trolley and chain hoist installation, etc. (Circular 49).

CUMBERLAND, MD.—Plans city-owned electric light and power plant. Application made to State Legislature for permission to issue bonds for $1,500,000 for plant and distribution system.

NEW YORK, N. Y. — Public Works Branch, United States Treasury Department, Washington, D. C., soon takes bids for new two-story postoffice on Grand Concourse, Bronx, including power plant, conduit system, power wiring and equipment, lighting fixtures, etc. Appropriation of $1,575,000 has been authorized.

DARLINGTON, WIS. — Has authorized bond issue of $125,000 for new city-owned electric light and power plant, for which plans will soon be drawn.

CUSHING, OKLA.—Has secured permission from Supreme Court to arrange bond issue of $280,000 for new city-owned electric light and power plant and will proceed with project at early date. Total cost about $300,000 with power lines.